

AN  
ANATOMICAL EXPOSITION  
OF THE  
STRUCTURE  
OF THE  
HUMAN BODY.

By JAMES BENIGNUS WINSLOW,  
PROFESSOR OF PHYSIC, ANATOMY, AND SURGERY IN  
THE UNIVERSITY OF PARIS,  
MEMBER OF THE ROYAL ACADEMY OF SCIENCES, AND  
OF THE ROYAL SOCIETY AT BERLIN, &c.

TRANSLATED FROM THE FRENCH ORIGINAL,

By G. DOUGLAS, M.D.

ILLUSTRATED WITH COPPER-PLATES.

IN TWO VOLUMES.

VOLUME II.

THE SIXTH EDITION.

---

EDINBURGH:  
Printed for ALEXANDER DONALDSON, and CHARLES ELLIOT.  

---

M,DCC,LXXII.





T O

Dr. B R O X O L M E.

S I R,

**A**N English physician, eminent in all the branches of his profession, is undoubtedly the most proper person to recommend a laudable attempt made by an obscure beginner, toward the improvement of physic in the English dominions. I shall make no further apology for prefixing your name to this physical part of an English edition of the best system of anatomy that has hitherto appeared. I have the honour to be, with the greatest respect,

S I R,

*Your most obedient,*

Bow-Lane, Nov. 1.

1732.

*Most obliged servant,*

G. DOUGLAS.

Vol. II.

b

THE UNIVERSITY OF CHICAGO

LIBRARY OF THE UNIVERSITY OF CHICAGO  
1215 EAST 58TH STREET  
CHICAGO, ILL. 60637  
U.S.A.

THE UNIVERSITY OF CHICAGO  
LIBRARY OF THE UNIVERSITY OF CHICAGO  
1215 EAST 58TH STREET  
CHICAGO, ILL. 60637  
U.S.A.

THE UNIVERSITY OF CHICAGO  
LIBRARY OF THE UNIVERSITY OF CHICAGO  
1215 EAST 58TH STREET  
CHICAGO, ILL. 60637  
U.S.A.

# THE C O N T E N T S OF THE SECOND VOLUME.

## S E C T. IV. The ARTERIES.

|                                   | <i>Numb.</i> |                                  | <i>Numb.</i> |
|-----------------------------------|--------------|----------------------------------|--------------|
| <b>I</b> Introduction             | 1            | Arteriæ œsophagæ                 | 114          |
| The aorta in general              | 5            | Arteriæ intercostales inferiores | 115          |
| The general division of the aorta | 8            | Arteriæ axillares                | 121          |
| The distribution of the branches  |              | Arteria thoracica superior       | 123          |
| of the aorta in general           | 18           | Arteria thoracica inferior       | 125          |
| Arteriæ coronariæ cordis          | 41           | Arteriæ scapulares               | 126          |
| The arteriæ carotides in general  | 45           | Arteria humeralis                | 128          |
| Arteria carotis externa           | 50           | Arteria brachialis               | 131          |
| Arteria carotis interna           | 71           | Arteria cubitalis                | 144          |
| Arteria subclavia                 | 80           | Arteria radialis                 | 160          |
| Arteria thymica                   | 84           | Arteria diaphragmatica           | 172          |
| Arteria pericardîa                | 85           | Arteria cœliaca                  | 176          |
| Arteria mediastina                | 86           | Arteria ventriculi coronaria     | 179          |
| Arteria trachealis                | 87           | Arteria hepatica                 | 182          |
| Arteria mammaria interna          | 88           | Arteria splenica                 | 190          |
| Arteria cervicalis                | 91           | Arteria mesenterica superior     | 196          |
| Arteria vertibralis               | 95           | Arteria mesenterica inferior     | 208          |
| Arteria basilaris                 | 100          | Arteriæ renales                  | 214          |
| Arteriæ spinales                  | 101          | Arteria capsulares               | 218          |
| Arteria auditoria interna         | 102          | Arteriæ spermaticæ               | 219          |
| Arteria meningæa posterior        | 103          | Arteriæ lumbares                 | 224          |
| Arteria intercostalis superior    | 104          | Arteriæ sacræ                    | 227          |
| Ductus arteriosus in ligamentum   |              | Arteriæ iliacæ                   | 228          |
| versus                            | 108          | Arteriæ crurales                 | 255          |
| Arteria bronchialis               | 109          |                                  |              |

## S E C T. V. The VEINS.

|                             | <i>Numb.</i> |                                   | <i>Numb.</i> |
|-----------------------------|--------------|-----------------------------------|--------------|
| <b>I</b> Introduction       | 1            | Vena azygos et venæ intercostales | 39           |
| The general division of the |              | Venæ pectorales internæ           | 55           |
| vena cava                   | 8            | Venæ subclaviæ                    | 66           |
| Vena cava superior          | 18           | Venæ jugulares externæ            | 70           |
| Vena cava inferior          | 33           | Vena jugularis externa anterior   | 72           |
|                             |              | b 2                               | Vena         |



# THE CONTENTS.

|                                  | <i>Numb.</i> |                              | <i>Numb.</i> |
|----------------------------------|--------------|------------------------------|--------------|
| Vena jugularis externa posterior | 90           | The continuation of the vena |              |
| Vena jugularis interna           | 102          | cruralis                     | 203          |
| Vena vertebralis                 | 110          | Vena saphena minor           | 208          |
| Vena axillaris                   | 118          | Vena poplitea                | 211          |
| Vena cephalica                   | 122          | Vena tibialis anterior       | 216          |
| Vena basilica                    | 132          | Vena tibialis posterior      | 221          |
| Vena cava inferior               | 143          | Vena peronæa                 | 225          |
| Venæ iliacæ                      | 166          | Vena portæ                   | 228          |
| Vena hypogastrica                | 175          | Vena mesaraica major         | 242          |
| Vena cruralis                    | 183          | Vena splenica                | 252          |
| Vena saphena                     | 190          | Vena hæmorrhoidalis interna  | 263          |

## S E C T. VI. The NERVES.

|                                        | <i>Numb.</i> |                                       | <i>Numb.</i> |
|----------------------------------------|--------------|---------------------------------------|--------------|
| <b>I</b> Introduction                  | 1            | in general                            | 197          |
| The nerves of the medulla ob-          |              | The brachial nerves in general        | 198          |
| longata                                | 6            | The fourth pair of cervical nerves    |              |
| The nerves of the medulla spinalis     | 7            |                                       | 212          |
| Nervi olfactorii                       | 9            | The fifth pair of cervical nerves     | 215          |
| Nervi optici                           | 14           | The last two pairs of cervical nerves |              |
| Nervi motores oculorum communes        |              |                                       | 219          |
|                                        | <i>ib.</i>   | Nervus musculo-cutaneus               | 222          |
| Nervi trochleares                      | 25           | Nervus medianus                       | 226          |
| Nervi trigemini                        | 28           | Nervus cubitalis                      | 231          |
| Nervus ophthalmicus                    | 34           | Nervus cutaneus internus              | 238          |
| Nervus maxillaris superior             | 44           | Nervus radialis                       | 242          |
| Nervus maxillaris inferior             | 55           | Nervus axillaris                      | 253          |
| Nervi motores externi                  | 73           | Nervi costales                        | 255          |
| Nervi auditorii                        | 78           | Nervi lumbares                        | 265          |
| Nervi sympathetici minimi              | 84           | The first pair of lumbar nerves       | 268          |
| Nervi sympathetici medii               | 104          | The second pair of lumbar nerves      |              |
| Nervi accessorii octavi paris          | 143          |                                       | 279          |
| Nervi hypoglossi externi               | 148          | The third pair of lumbar nerves       | 285          |
| Nervi suboccipitales                   | 154          | The fourth pair of lumbar nerves      | 289          |
| The vertebral nerves in general        | 165          | Nervus obturator                      | 293          |
| The first pair of cervical nerves      | 170          | The fifth pair of lumbar nerves       | 295          |
| The second pair of cervical nerves     |              | Nervi sacri                           | 297          |
|                                        | 176          | Nervus cruralis                       | 308          |
| The third pair of cervical nerves      | 187          | Nervus sciaticus                      | 318          |
| The last four pairs of cervical nerves |              | Nervi sympathetici maximi             | 357          |

## S E C T. VII. The parts of the body in general, and the integuments in particular.

|                                | <i>Numb.</i> |                                   | <i>Numb.</i> |
|--------------------------------|--------------|-----------------------------------|--------------|
| <b>I</b> Introduction          | 1            | The general division of the human |              |
| The explication of the general |              | body                              | 28           |
| terms of anatomy               | 6            | The parts of the head             | 33           |
|                                |              | The                               |              |

# THE CONTENTS.

|                                    | <i>Numb.</i> |                                 | <i>Numb.</i> |
|------------------------------------|--------------|---------------------------------|--------------|
| The parts of the neck              | 66           | The uses of the skin            | 15           |
| The parts of the thorax            | 70           | The membrana adiposa            | 17           |
| The parts of the abdomen           | 78           | The nails                       | 19           |
| The parts of the upper extremities | 93           | The hairs                       | 20           |
| The parts of the lower extremities | 99           | The supposed integuments of the | 20           |
| The skin                           | 110          | ancients                        | 20           |
| The cuticula                       | 137          |                                 |              |

## S E C T. VIII. The ABDOMEN.

|                                                | <i>Numb.</i> |                                      | <i>Numb.</i> |
|------------------------------------------------|--------------|--------------------------------------|--------------|
| <b>I</b> ntroduction                           | 1            | The uses of the mesentery            | 381          |
| The external conformation of the abdomen       | 2            | The uses of the lacteal vessels      | 386          |
| The integuments of the abdomen                 | 13           | The uses of the liver                | 387          |
| The cavity of the abdomen                      | 19           | The uses of the spleen, omentum, &c. | 388          |
| Peritonæum                                     | 22           | Renes                                | 302          |
| Ventriculus                                    | 43           | Ureteres                             | 418          |
| The intestines in general                      | 87           | Glandulæ renales                     | 432          |
| The small intestines                           | 102          | Vesica urinaria                      | 449          |
| Intestinum duodenum                            | 104          | Urachus                              | 455          |
| Intestinum jejunum                             | 120          | Arteriæ umbilicales                  | 456          |
| Intestinum ileum                               | 132          | The parts of generation in males     | 466          |
| The great intestines                           | 136          | The spermatic vessels                | 470          |
| Intestinum cæcum                               | 138          | Testes                               | 483          |
| Intestinum colon                               | 147          | Epididymis                           | 490          |
| Intestinum rectum & anus                       | 170          | Scrotum                              | 494          |
| The muscles of the anus                        | 179          | Dartos                               | 499          |
| Mesenterium & mesocolon                        | 196          | Vasa deferentia                      | 505          |
| Glandulæ mesentericæ                           | 208          | The coats of the testes              | 514          |
| Vasa lymphatica & lactea                       | 211          | Musculus cremaster                   | 519          |
| Receptaculum chili                             | 222          | Corpora cavernosa penis              | 524          |
| The blood-vessels and nerves of the intestines | 225          | Urethra                              | 531          |
| Hepar                                          | 251          | Prostatæ                             | 535          |
| Vena portæ hepatica                            | 276          | Glans                                | 538          |
| Pori bilarii & ductus hepaticus                | 278          | Caruncula                            | 544          |
| Ductus cholidochus                             | 289          | Vesiculæ seminales                   | 546          |
| Vesicula fellis                                | 291          | The lacunæ of the urethra            | 554          |
| Remarks on the vessels, &c. of the liver       | 306          | Anti-prostatæ                        | 556          |
| Pancreas                                       | 320          | The orifice of the urethra           | 557          |
| The small pancreas                             | 325          | Præputium                            | 560          |
| Lien                                           | 330          | Ligamentum penis suspensorium        | 565          |
| Omentum                                        | 352          | The muscles of all these parts       | 568          |
| The little omentum                             | 357          | The parts of generation in females   | 590          |
| Appendices epiploicæ                           | 366          | Uterus                               | 591          |
| The uses of the intestines                     | 372          | Ligamenta lata                       | 603          |
| The uses of the muscles of the anus            | 380          | Ovaria                               | 605          |
|                                                |              | Tubæ Falloppianæ                     | 608          |
|                                                |              | Pubes                                | 625          |
|                                                |              | Sinus                                |              |

# THE CONTENTS.

|                         | Numb. | Numb.                             |
|-------------------------|-------|-----------------------------------|
| anus & alæ              | 626   | Circulus membranofus or hymen 654 |
| lacunæ                  | 629   | Carunculae myrtiformes 655        |
| clitoris                | 632   | Plexus retiformis 656             |
| lymphæ                  | 640   | Observations concerning the liga- |
| urethra                 | 642   | ments of the bladder, &c. in both |
| The canal of the uterus | 644   | sexes 659                         |

## SECT. IX. The THORAX.

|                                  | Numb. | Numb.                               |
|----------------------------------|-------|-------------------------------------|
| Introduction                     | 1     | Pericardium 79                      |
| The external conformation of the |       | The uses of the heart 95            |
| thorax                           | 2     | The circulation of the blood 80     |
| The cavity of the thorax         | 5     | Pulmones 95                         |
| Mammæ                            | 7     | Bronchia 101                        |
| Ductus lactiferi                 | 13    | Vesiculæ bronchiales 105            |
| Areola                           | 14    | Lobuli 106                          |
| Papillæ                          | 17    | The interlobular substance 107      |
| Pleura & mediastinum             | 25    | The vascular texture 110            |
| Thymus                           | 38    | The blood-vessels, nerves and liga- |
| Cor                              | 41    | ments of the lungs 111              |
| The ventricles of the heart      | 45    | Trachea arteria 128                 |
| The valves of the heart          | 59    | The bronchial glands 144            |
| The aorta in general             | 64    | The uses of the lungs 150           |
| The plumonary artery in general  | 65    | Oesophagus 158                      |
| The auricles of the heart        | 66    | Ductus thoracicus 164               |
| The coronary vessels             | 71    |                                     |

## SECT. X. The HEAD.

|                                     | Numb. | Numb.                              |
|-------------------------------------|-------|------------------------------------|
| THE brain in general                | 3     | Thalamai nervorum opticorum 75     |
| Dura mater                          | 6     | Tubercula 79                       |
| The folds and septa of the dura ma- |       | Canalis medius 80                  |
| ter                                 | 12    | Foramen commune posterius 81       |
| The elongations of the dura mater   | 21    | Glandula pinealis 82               |
| The vessels of the dura mater       | 25    | Infundibulum 84                    |
| The sinuses of the dura mater       | 28    | The third ventricle 85             |
| Pia mater                           | 49    | Plexus choroides 87                |
| Membrana arachnoides                | 51    | Glandula pituitaria 91             |
| Cerebrum                            | 53    | Cerebellum 92                      |
| Corpus callosum                     | 62    | The fourth ventricle 96            |
| The medullary arch and centrum      | 64    | Medulla oblongata 102              |
| ovale                               | 65    | Medulla spinalis 119               |
| Ventriculi laterales                | 68    | The nerves of both medullæ from    |
| Septum lucidum                      | 69    | their origin to their going out of |
| Fornix                              | 72    | the cranium 130                    |
| The eminences of the cerebrum       | 73    | The nerves of the medulla oblon-   |
| Corpora striata                     |       | gata 132                           |
|                                     |       | The                                |

# THE CONTENTS.

ix

|                                                     | Numb. |                                        | Numb. |
|-----------------------------------------------------|-------|----------------------------------------|-------|
| The nerves of the medulla spinalis                  | 148   | The vessels and nerves of the nose     | 357   |
| The blood-vessels of the brain and medulla spinalis | 162   | The uses of the nose                   | 360   |
| The uses of the brain and of its appendages         | 181   | The ear                                | 361   |
| M. Steno's dissertation on the anatomy of the brain | 195   | The external ear                       | 363   |
| Pericranium                                         | 196   | The internal ear                       | 384   |
| The eye                                             | 202   | Tuba Eustachiana                       | 386   |
| The orbits                                          | 204   | Membrana tympani                       | 393   |
| The globe of the eye                                | 207   | Cellulæ mastoidæ                       | 397   |
| The coats of the eye                                | 212   | The ligaments of the ossicula auditus  | 398   |
| Tunica sclerotica                                   | ib.   | The muscle of the internal ear         | 399   |
| Tunica choroides                                    | 217   | The vessels and nerves of the ear      | 408   |
| Uvea                                                |       | The mouth                              | 416   |
| Iris                                                |       | Larynx                                 | 421   |
| Pupilla                                             | 220   | Cartilago thyroides                    | 423   |
| Processus ciliares                                  |       | Cartilago cricoides                    | 426   |
| Tunica retina                                       | 223   | Cartilaginee arytenoides               | 429   |
| The humours of the eye                              | 228   | Epiglottis                             | 431   |
| The vitreous humour                                 | ib.   | The ligaments of the larynx            | 432   |
| The crystalline humour                              | 232   | Glottis                                | 435   |
| The aqueous humour                                  | 233   | The muscles of the larynx              | 440   |
| Tunica albuginea                                    | 240   | Musculi sterno-thyroidæi               | 441   |
| The muscles of the eye                              | 241   | Musculi thyro-hyoidæi                  | 447   |
| The uses of the muscles of the eye                  | 249   | Musculi crico-thyroidæi                | 448   |
| Supercilia                                          | 255   | Musculi crico-arytenoidæi              | 450   |
| Musculi frontales                                   | 257   | Musculi thyro-arytenoidæi              | 452   |
| Musculi occipitales                                 | 260   | Musculi arytenoidæi                    | 453   |
| Musculi superciliares                               | 265   | Musculi thyro-epiglottici              | 456   |
| Palpebræ                                            | 267   | Musculi aryteno-epiglottici            | 457   |
| Tarsi                                               | 269   | Musculi hyo-epiglottici                | 458   |
| Ligamenta tarforum lata                             | 271   | The uses of the larynx                 | 459   |
| Membrana conjunctiva                                | 272   | Pharynx                                | 468   |
| Glandula lacrymalis                                 | 272   | The muscles of the pharynx             | 473   |
| Cilia                                               | 277   | Musculi cephalo-pharyngæi              | 475   |
| Glandulæ ciliares                                   | 279   | Musculi petro-pharyngæi                | 476   |
| Puncta lacrymalia                                   | 280   | Musculi spheno-pharyngæi               | ib.   |
| Caruncula lacrymalis                                | 283   | Musculi pterygo-pharyngæi              | ib.   |
| The muscles of the palpebræ                         | 284   | Musculi stylo-pharyngæi                | 477   |
| The vessels of the eye                              | 296   | Musculi peristaphylo-pharyngæi         | 478   |
| The nerves of the eye                               | 302   | Musculi hypero-pharyngæi               | ib.   |
| The uses of the eye                                 | 312   | Musculi glosso-pharyngæi               | ib.   |
| The nose                                            | 315   | Musculi hyo-pharyngæi                  | 479   |
| The cartilages of the nose                          | 322   | Musculi genio-pharyngæi                | 480   |
| The muscles of the nose                             | 329   | Musculi syndesmo-pharyngæi             | 481   |
| Membrana pituitaria                                 | 334   | Musculi thyro-pharyngæi                | 482   |
| The sinuses of the nose                             | 339   | Musculi crico-pharyngæi                | 483   |
| Sacculus lacrymalis                                 | 342   | Musculus œsophagus                     | 484   |
| Ductus incisorii                                    | 350   | Musculus thyro-adenoidæus              | ib.   |
|                                                     |       | The uses of the muscles of the pharynx | 485   |
|                                                     |       |                                        | The   |



|                                    | <i>Numb.</i> |                                     | <i>Numb.</i> |
|------------------------------------|--------------|-------------------------------------|--------------|
| The palate                         | 486          | The muscles of the lips             | 548          |
| Septum palati                      | 487          | Musculi semi-orbiculares            | 553          |
| Uvula                              | 489          | Musculi supra-semi-orbiculares      | 555          |
| The muscles of the palate, &c.     | 492          | Musculi buccinatores                | 556          |
| Musculi glosso-staphylini          | 495          | Ligamenta inter-maxillaria          | 557          |
| Musculi pharyngo-staphylini        | 496          | Musculi zygomatici                  | 559          |
| Musculi thyro-staphylini           | 497          | Musculi canini                      | 561          |
| Musculi spheno-falpingo-staphylini | 498          | Musculi incisorii laterales         | 562          |
|                                    | 500          | Musculi incisorii medii             | 565          |
| Musculi pterygo-staphylini         | 500          | Musculi triangulares                | 566          |
| Musculi petro-falpingo-staphylini  | 501          | Musculus quadratus                  | 567          |
|                                    | 502          | Musculi incisorii inferiores        | 568          |
| Musculi staphylini                 | 502          | Musculi cutanei                     | 570          |
| The tongue                         | 504          | The salival glands                  | 575          |
| Papillæ of the tongue              | 507          | Glandulæ parotides                  | 576          |
| Musculi linguæ interiores          | 513          | Glandulæ maxillares                 | 579          |
| Musculi linguæ exteriores          | 515          | Glandulæ sublinguales               | 581          |
| Musculi mylo-glossi                | 517          | Glandulæ molares                    | 583          |
| Musculi stylo-glossi               | 518          | Glandulæ buccales, labiales, & lin- |              |
| Musculi hyo-glossi                 | 520          | guales                              | 584          |
| Musculi genio-glossi               | 522          | Amygdalæ                            | 586          |
| The ligaments of the tongue        | 530          | Glandula thyroïdes                  | 588          |
| The uses of the tongue             | 539          | Glandulæ lymphaticæ                 | 591          |
| The cheeks and lips                | 542          | The glands in general               | 601          |
| The gums                           | 544          |                                     |              |



Monday morning

A N  
ANATOMICAL EXPOSITION  
OF THE  
STRUCTURE  
OF THE  
HUMAN BODY.

---

S E C T. IV.

*A Description of the Arteries.*

1. **T**HE heart throws the blood into two great arteries; one of which is *Introduction.* named *aorta*, the other *arteria pulmonalis*.
  2. The *aorta* distributes the blood to all the parts of the body, for the nourishment of the parts, and for the secretion of different fluids.
  3. The *arteria-pulmonalis* carries the venal blood through all the capillary vessels of the lungs.
  4. Both these great or general arteries are subdivided into several branches, and into a great number of ramifications. In this section, I shall describe the distributions of the *aorta*, leaving the pulmonary artery to the particular history of the lungs.
  5. The basis of the heart being very much inclined to the right side, and turned a little backward, the *aorta* goes out
- VOL. II.                      A                      from
- No more of the same

*The aorta in  
General.*

from it in a direct course, nearly over-against the fourth vertebra of the back. Its course, I say, is direct with respect to the heart; but with respect to all the rest of the body, it ascends obliquely from the left to the right hand, and from before, backward.

6. Soon after this, it bends obliquely from the right hand to the left, and from before, backward, reaching as high as the second vertebra of the back; from whence it runs down again in the same direction, forming an oblique arch. The middle of this arch is almost opposite to the right side or edge of the superior portion of the sternum, between the cartilaginous extremities or sternal articulations of the first two ribs.

7. From thence the aorta descends in a direct course along the anterior part of the vertebræ, all the way to the Os Sacrum, lying a little toward the left hand; and there it terminates in two subordinate or collateral trunks, called *arterie iliacæ*.

8. The aorta is, by anatomists, generally divided into the aorta ascendens and aorta descendens, though both are but one and the same trunk. It is termed *ascendens*, from where it leaves the heart to the extremity of the great curvature or arch. The remaining part of this trunk from the arch to the Os Sacrum or bifurcation already mentioned, is named *descendens*.

9. The aorta descendens is further divided into the superior and inferior portions; the first taking in all that lies above the diaphragm; the other, all that lies between the diaphragm and the bifurcation.

10. The aorta ascendens is chiefly distributed to part of the thorax, to the head and upper extremities. The superior portion of the aorta descendens furnishes the rest of the thorax; the inferior portion furnishes the abdomen and lower extremities.

11. The great trunk of the aorta through its whole length, sends off immediately several branches which are afterwards differently ramified; and these arterial branches may be looked upon as so many trunks with respect to the other ramifications, which again may be considered as small trunks with regard to the ramifications that they send off.

12. The branches which go out immediately from the trunk

trunk of the aorta, may be termed original or capital branches; and of these some are large and others very small.

13. The large capital branches of the aorta, are these: two arteriæ subclaviæ; two carotides, one cæliaca, one mesenterica superior, two renales, formerly termed *emulgentes*, one mesenterica inferior, and two iliacæ.

14. The small capital branches are chiefly the arteriæ coronariæ cordis, bronchiales, œsophagææ, intercostales, diaphragmaticæ inferiores, spermaticæ, lumbares, and sacræ.

15. These capital branches or arteries are for the most part disposed in pairs; there being none in odd numbers but the cæliaca, the two mesentericæ, some of the œsophagææ, the bronchialis, and sometimes the sacræ.

16. The ramifications of each capital branch are in uneven numbers with respect to their particular trunks; but with respect to the ramifications of the like capital trunks on the other side, they are disposed in pairs. Among the branches there are in odd numbers, none but the arteria sacra when it is single, and the œsophagææ, the ramifications of which are sometimes found in pairs.

17. Before I enter upon the detail of each of these particular arteries, many of which have proper names; it will be convenient to give a short view of the disposition and distribution of the principal arterial branches, as a general plan to which all the particularities of each distribution may afterwards be referred: for I have found by experience, that the common method of describing the course of all the ramifications of these vessels, without having first given a general idea of the principal branches, is very troublesome to beginners.

18. The aorta gives rise to two small arteries, called *coronariæ cordis*, which go to the heart and its auricles; one of which is situated anteriorly, the other posteriorly, and sometimes they are three in number.

*General distribution  
of the branches of  
the aorta.*

19. From the upper part of the arch or curvature, the aorta sends out commonly three, sometimes four large capital branches, their origins being very near each other. When there are four, the two middle branches are termed *arteriæ carotides*; the other two, *subclaviæ*; and both are distinguished into right and left,

20. When there are but three branches, which is ofteneft the cafe, the first is a fhort trunk, common to the right fubclavian and carotid, the fecond is the left fubclavian, and the third the left carotid. Sometimes, though very rarely, thefe four arteries unite in two trunks.

21. The origin of the left fubclavian terminates the aorta afcendens; but I have fometimes obferved four branches, the first three of which were thofe already mentioned, and the fourth a diftinct trunk of the left vertebral artery.

22. It muft be obferved, that thefe large branches which arife from the curvature of the aorta, are fituated obliquely; the first, or that which is moft on the right hand, lying more forward than the reft, and the laft, which is moft on the left hand, more backward. The first and fecond or middle branches, are generally in the middle of the arch, and the third lower down. Sometimes the first alone is in the middle; all which varieties depend on the obliquity of the arch.

23. The carotid arteries run up directly to the head, each of them being first divided into two, one external, the other internal. The external artery goes chiefly to the outer parts of the head and dura mater, or first covering of the brain. The internal enters the cranium, through the bony canal of the Os Petrosum; and is diftributed through the brain by a great number of ramifications.

24. The fubclavian arteries feperate laterally and almoft tranfverfely, each toward that fide on which it lies, behind and under the claviculæ, from whence they have their name. The left feems to be fhorter, and runs more obliquely than the right.

25. The fubclavian on each fide terminates at the upper edge of the first rib, between the lower infertions of the first scalenus mufcle; and there, as it goes out of the thorax, takes the name of *arterea axillaris*.

26. During this courfe of the fubclavian artery, taking in the common trunk of the right fubclavian, feveral arteries arife from it, viz. the mammaria interna, mediastina, pericardia, diaphragmatica minor five fuperior, thymica, and trachealis.

27. The thymica and trachealis on each fide are in fome fubjects only branches of one fmall trunk which fprings from the common trunk of the right fubclavian and carotid.

28. They



28. They are generally small arteries which run sometimes separate, and sometimes partly separate and partly joined.

29. The subclavian sends off likewise the *mammaria interna*, *vertebrales*, *cervicales*, and sometimes several of the upper *intercostales*.

30. The axillary artery, which is only a continuation of the subclavian, from where it goes out of the thorax, to the axilla, detaches chiefly the *mammaria externa* or *thoracica superior*, *thoracica inferior*, *scapulares externæ*, *scapularis interna*, *humeralis* or *muscularis*, &c. Afterwards it is continued, by different ramifications and under different names, over the whole arm, all the way to the ends of the fingers.

31. The superior portion of the *aorta descendens* gives off the *arteriæ bronchiales*, which arise sometimes by a small common trunk, sometimes separate, and sometimes do not come immediately from the aorta. It next sends off the *œsophagææ*, which may be looked upon as *mediastinæ posteriores*; and then the *intercostales* from its posterior part, which in some subjects come all from this portion of the aorta, in others only the lowest eight or nine.

32. The small anterior arteries here mentioned are generally at their origins, single and in uneven numbers, but they divide soon after, toward the right and left.

33. The inferior portion of the descending aorta, as it passes through the diaphragm, gives off the *diaphragmaticæ inferiores* or *phrenicæ*, which however do not always come immediately from the aorta. Afterwards it sends off several branches anteriorly, posteriorly, and laterally.

34. The anterior branches are *cæliaca*, which supplies the stomach, liver, spleen, pancreas, &c.; the *mesenterica superior*, which goes chiefly to the mesentery, to the small intestines, and to that part of the great intestines, which lies on the right side of the abdomen; the *mesenterica inferior*, which goes to the great intestines on the left side, and produces the *hemorrhoidalis interna*, and lastly, the right and left *arteriæ spermaticæ*.

35. The posterior branches are the *arteriæ lumbares*, of which there are several pairs, and the *sacræ* which do not always come from the trunk of the aorta.

36. The lateral branches are the *capsulares* and *adiposæ*, the origin of which often varies; the *renales*, formerly termed

ed *emulgentes*, and the *iliacæ*, which terminate the aorta by the bifurcation already mentioned.

37. The iliac artery on each side, is commonly divided into the external or anterior, and internal or posterior.

38. The internal iliaca is likewise named *arteria hypogastrica*; and its ramifications are distributed to the viscera contained in the pelvis, and to the neighbouring parts, both internal and external.

39. The iliaca externa, which is the true continuation of the iliac trunk, and alone deserves that name, goes on to the inguen, and then out of the abdomen, under the *ligamentum Falloppii*; having first detached the *epigastrica*, which goes to the *musculi abdominis recti*. Having quitted the abdomen, it commences *arteria cruralis*, which runs down upon the thigh, and is distributed by many branches and ramifications to all the lower extremity.

40. I shall now go on to examine particularly all the capital or original branches of the aorta, from their origin, to the entry of them, and of their ramifications into all the parts of the body, and all the different viscera and organs.

41. The cardiac or coronary arteries of the heart, arise from the aorta immediately on its leaving the heart. They are two in number; and, according to the natural situation of the heart, one is rather superior than anterior, the other rather inferior than posterior.

42. They go out near the two sides of the pulmonary artery, which having first surrounded, they afterwards run upon the basis of the heart in form of a kind of crown or garland, from whence they are called *coronariae*; and then pursue the superficial traces of the union of the two ventricles, from the basis of the heart to the apex.

43. They send communicating branches to each other, which are afterward lost in the substance of the heart, as shall be shown more particularly in describing that organ.

44. We sometimes meet with a third coronary artery, which arises from the aorta more backward, and is spent on the posterior or lower side of the heart.

45. The carotid arteries are commonly demonstrated after the subclavian; but I chuse to describe them first, that I  
may

may afterwards be able to pursue the arteries of the thorax, arising partly from the subclaviæ, and partly from the aorta descendens, without interruption.

*The arteria carotides in general.*

46. These arteries are two in number, one called the *right carotid*, the other the *left*. They arise near each other, from the curvature or arch of the aorta, the left immediately; the right most commonly from the trunk of the subclavia on the same side, as has been already observed.

47. They run upon each side of the trachea arteria, between it and the internal jugular vein, as high as the larynx, without any ramification. During this course, therefore, they may be named *carotid trunks*, or general, common, and original carotids. Each of these trunks is afterwards ramified in the following manner.

48. The trunk having reached as high as the larynx, is divided into two large branches or particular carotids, one named *external*, the other *internal*, because the first goes chiefly to the external parts of the head, the second enters the cranium, and is distributed to the brain.

49. The external carotid is anterior, the internal posterior; and the external is even situated more inward and nearer the larynx than the other, but the common names may still be retained, as being taken not from their situation, but from their distribution.

50. The external carotid is the smallest, and yet appears by its direction to be a continuation of the common trunk. It runs insensibly outward, between the external angle of the lower jaw, and the parotid gland, which it supplies as it passes. Afterwards it ascends on the foreside of the ear, and ends in the temples.

*Arteria carotis externa.*

51. In this course it sends off several branches, which may well enough be divided into anterior or internal, and posterior or external; and the principal branches of each kind are these.

52. The first anterior or internal branch goes out from the very origin of the carotid on the inside; and having presently afterward taken a little turn, and sent off branches to the jugular glands near it, to the fat and skin; it runs transversely, and is distributed to the glandulæ thyroidææ, and to the muscles and other parts of the larynx; for which reason



I name it *laryngææ* or *gutturalis superior*. It likewise sends some branches to the pharynx and muscles of the Os Hyoides.

53. The second anterior branch passes over the nearest cornu of the Os Hyoides, to the muscles of that bone and of the tongue; and to the glandulæ sublinguales; afterwards passing before the cornu of the Os Hyoides, it loses itself in the tongue, from whence it has been called *arteria sublingualis*; and it is the same artery which others have named *ranina*.

54. The third branch or *arteria maxillaris inferior* goes to the maxillary gland, to the styloide and mastoide muscles, to the parotid and sublingual glands, to the muscles of the pharynx, and to the small flexors of the head.

55. The fourth branch, which I name *arteria maxillaris externa*, passes anteriorly on the masseter muscle, and middle of the lower jaw near the chin, from whence it has a denomination in some languages, which cannot be expressed in English. Afterwards it runs under the musculus triangularis labiorum, which it supplies as well as the buccinator and the quadratus menti.

56. It sends off a particular branch, very much contorted, which divides at the angular commissure of the lips, and running in the same manner along the superior and inferior portions of the musculus orbicularis, it communicates on both sides with its fellow, and thereby forms a kind of *arteria coronaria labiorum*.

57. Afterwards it ascends towards the nares, and is distributed to the muscles, cartilages, and other parts of the nose, sending down some twigs which communicate with the coronary artery of the lips. Lastly, it reaches the great angle of the eye, and is ramified and lost on the musculus orbicularis palpebrarum, superciliaris, and frontalis. Through all this course, it is named *arteria angularis*.

58. The fifth branch arises over-against the condyle of the lower jaw, and as it is very considerable, I call it *maxillaris interna*. It passes behind the condyle, and having given off a twig among the muscoli pterygoidæi; it is divided into three principal branches.

59. The first branch goes through the inferior orbitary or spheeno-maxillary fissure, to the orbit, after having supplied the

the



the muscoli peristaphylini, and the glandulous membrane of the posterior nares, through the foramen speno-palatium. I name this branch *spheno-maxillaris*.

60. It is distributed inferiorly and laterally to the parts contained in the orbit, and detaches a small subaltern branch through the extremity of the superior orbitary or sphenoidal fissure, which enters the cranium, and is spent upon the dura mater, communicating there with the other artery of the dura mater, which enters by the foramen spinale of the sphenoidal bone.

61. It sends off likewise another subaltern branch, which passes through the posterior opening of the orbitary canal, and having furnished the maxillary sinus and the teeth, goes out by the inferior orbitary hole, and on the cheek communicates with the angular artery.

62. The second of the three branches runs through the canal of the lower jaw, and being distributed to the alveoli and teeth, goes out at the hole near the chin, and loses itself in the neighbouring muscles, communicating with the rami of the arteria maxillaris externa.

63. The third branch of the maxillaris interna runs up between the internal and external carotids, passes through the foramen spinale of the sphenoidal bone, and is distributed to the dura mater by several ramifications which run forward, upward and backward; the uppermost communicating with those on the other side, above the longitudinal sinus of the dura mater.

64. This artery of the dura mater, which may be termed *spheno-spinalis*, to distinguish it from those that go to the same part by another course, arises sometimes from the trunk of the external carotid, behind the origin of the laryngæa or gutturalis superior, and sometimes from the first ramus of the maxillaris interna, just before it enters the spheno-maxillary fissure.

65. The sixth anterior or internal branch, which is very small, is spent on the musculus masseter.

66. The first external or posterior branch is named *arteria occipitalis*. It passes obliquely before the internal jugular vein, and having given twigs to the musculus stylo-hyoidæus, stylo-glossus, and digastricus, it runs between the styloide and mastoide apophyses, along the mastoide groove, and goes to

the muscles and integuments which cover the Os Occipitis, turning several times in an undulating manner as it ascends backward.

67. It communicates by a descending branch with the vertebral and cervical arteries, as has been already said; near the top of the head, it communicates likewise with the posterior branches of the temporal artery, and it sends a branch to the foramen mastoidæum.

68. The second external branch spreads itself on the outward ear, by a great many small twigs on each side, several of which run inward, and furnish the cartilages, meatus auditorius, skin of the tympanum, and internal ear.

69. The trunk of the external carotid ascends afterward above the zygoma, passing between the angle of the lower jaw and parotid gland, and forms the temporal artery, which divides into an anterior, middle, and posterior branch.

70. The anterior branch of the temporal artery goes to the musculus frontalis, communicates with the arteria angularis, and sometimes gives off a very small artery, which pierces the internal apophysis of the Os Malæ all the way to the orbit. The middle branch goes partly to the musculus frontalis, partly to the occipitalis. The posterior branch goes to the occiput, and communicates with the arteria occipitalis. All these branches likewise furnish the integuments.

71. The internal carotid artery leaving the general trunk, is at first a little incurvated, appearing as if either it were the only branch of that trunk, or a branch of the trunk of the external carotid. Sometimes the curvature is turned a little outward, and then more or less inward, passing behind the neighbouring external carotid.

72. It is situated a little more backward than the carotis externa, and generally runs up without any ramification, as high as the lower orifice of the great canal of the apophysis petrosa of the Os Temporis. It enters this orifice directly from below upward, and afterward makes an angle according to the direction of the canal, the rest of which it passes horizontally being covered by a production of the dura mater.

73. At the end of this canal it is again incurvated from below

below upward, and enters the cranium through a notch of the sphenoidal bone. Then it bends from behind, forward, and makes a third angle on the side of the fella sphenoidalis; and again a fourth, under the clinoid apophysis of that fella.

74. As it leaves the bony canal to enter the cranium, it sends off a branch through the sphenoidal fissure to the orbit and eye; and soon afterward another, through the foramen opticum, by which it communicates with the external carotid.

75. Afterwards the internal carotid runs under the basis of the brain to the side of the infundibulum, where it is at a small distance from the internal carotid of the other side, and there it commonly divides into two principal branches, one anterior, and one posterior.

76. The anterior branch runs forward under the brain, first separating from that on the other side, then coming nearer again, it unites with it by an anastomosis or communication in the interstice between the olfactory nerves. Afterwards having sent off some small arteries, which accompany these nerves, it leaves its fellow, and divides into two or three branches.

77. The first of these branches goes to the anterior lobe of the brain; the second, which is sometimes double, is inverted on the corpus callosum, to which it gives some ramifications, as also to the falx of the dura mater, and middle lobe of the brain. The third, which in some subjects is a distinct branch, in others only a division of the second, goes to the posterior lobe of the brain. This might be looked upon as a third principal branch, lying between the other two.

78. The posterior branch communicates, first of all, with the vertebral artery of the same side, and then divides into several rami, which run between the superficial circumvolutions of the brain; and are ramified in many different directions on and between these circumvolutions, all the way to the bottom of the sulci.

79. All these ramifications are covered by the pia mater, in the duplicature of which they are distributed, and form capillary reticular textures in great numbers; and afterwards they are lost in the inner substance of the brain. The ante-



rior and middle branches produce the same kind of ramifications, and the anterior in particular, sends a twig to the corpus callosum.

80. The subclavian arteries are named from their situation near the claviculæ, in the transverse direction of which they run. They are two in number, one right, the other left; and they arise from the arch of the aorta, on each side of the left carotid, which commonly lies in the middle between them; but when both carotids go out separately, they both lie between the subclaviæ. These arteries terminate, or rather change their name, above the middle of the two first ribs, between the anterior insertions of the musculi scaleni.

81. The right subclavian is larger at the beginning than the left, when it produces the right carotid; its origin is likewise more anterior and higher, because of the obliquity of the arch of the aorta; for which reason also the left is shorter than the right, and runs more obliquely. Both of them are distributed much in the same manner; and therefore the description of one may likewise be applied to the other.

82. The right subclavian, the longest of the two, gives off, first of all, small arteries to the mediastinum, thymus, pericardium, aspera arteria, &c. which are named *mediastinæ*, *thymicæ*, *pericardiæ*, and *tracheales*. These small arteries sometimes go out from the subclavian itself, either separately, or by small common trunks; sometimes they are branches of the *mammaria interna*, especially the *mediastina*.

83. Afterward this right subclavian, at about a finger's breadth from its origin, often produces the common carotid of the same side; and at a small finger's breadth from the carotid, it gives off commonly three considerable branches, viz. the *mammaria interna*, *cervicalis*, and *vertebralis*, and sometimes an intercostal artery which goes to the first ribs called *intercostalis superior*.

84. The *arteria thymica* communicates with the *mammaria interna*, and sometimes arises from the anterior middle part of the common trunk of the subclavian and carotid. The thymus receives likewise some rami from the *mammaria interna*, and *intercostalis superior*.



perior. The same observation may be applied to the mediastina and pericardia.

85. The pericardia arises much in the same manner with the thymica, and runs down upon the pericardium all the way to the diaphragm, to which it sends some small ramifications. *Arteria pericardia.*

86. The mediastina arises sometimes immediately after the thymica, and is distributed principally to the mediastinum. *Arteria Mediastina.*

87. The trachealis, which may likewise be named *gutturalis inferior*, runs up from the subclavia, in a winding course, along the aspera arteria, to the glandulae thyroidae, and larynx, detaching small arteries to both sides, one of which runs to the upper part of the scapula. *Arteria trachealis.*

88. The internal mammary artery comes from the anterior and lower side of the subclavia, near the middle of the clavicle, and runs down for about one finger's breadth, behind the cartilages of the true ribs, an inch distant from the sternum. *Arteria mammaria interna.*

89. In its passage it sends rami to the thymus, mediastinum, pericardium, pleura, and intercostal muscles. It likewise detaches other branches, through these muscles, and between the cartilages of the ribs, to the pectoralis major, and other neighbouring muscular portions, to the mammae, membrana adiposa, and skin.

90. Several of these rami communicate, by anastomoses, with the mammaria externa, and other arteries of the thorax, especially in the substance of the pectoralis major, and likewise with the intercostals. Afterwards it goes out of the thorax on one side of the appendix ensiformis, and is lost in the musculus abdominis rectus, a little below its upper part; communicating, at this place, by several small ramifications with the arteria epigastrica; and, in its course, it gives branches to the peritonaeum, and to the anterior parts of the oblique and transverse muscles of the abdomen.

91. The cervical artery arises from the upper side of the subclavian, and is presently afterwards divided into two, which come out sometimes separately, sometimes by a small common trunk. The largest of these two arteries is anterior, the other posterior. *Arteria cervicalis.*

92. The

92. The anterior cervicalis, running behind the carotid of the same side, is distributed to the musculus coraco-hyoidæus, mastoidæus, cutaneus, sterno-hyoidæus, and sterno-thyroidæus, to the jugular glands, the aspera arteria, the muscles of the pharynx, bronchia, œsophagus, and to the anterior muscles which move the neck and head. This artery has been observed to send out the intercostalis superior.

93. The posterior cervicalis arises sometimes a little after the vertebralis, and sometimes from that artery. It passes under the transverse apophysis of the last vertebra of the neck; and sometimes through a particular hole in that apophysis; and from thence runs up backward in a winding course, on the vertebral muscles of the neck, and then returns in the same manner.

94. It communicates with a descending branch of the occipital artery, and with another of the vertebral artery above the second vertebra. It is distributed to the muscoli scaleni, angularis scapulæ, and trapezius, and to the jugular glands and integuments.

95. The vertebral artery goes out from the posterior and upper side of the subclavian, almost opposite to the mammaia interna and cervicalis. It runs up through all the holes in the transverse apophysis of the vertebræ of the neck, and, in its passage, sends off little twigs through the lateral notches of these vertebræ, to the medulla spinalis and its coverings. It also gives arteries to the vertebral muscles, and to other muscles near them.

96. As it passes through the transverse hole of the second vertebra, it is generally incurvated, to accommodate itself to the particular obliquity of this foramen, mentioned in the description of the skeleton, N<sup>o</sup> 479. And between this hole and that in the first vertebra, it takes another larger turn in a contrary direction to the former. Having passed the transverse hole of the first vertebra, it is considerably incurvated a third time, from before backwards, as it goes through the superior and posterior notch in this vertebra.

97. At this third curvature, it sends off a small branch which is ramified on the outer and posterior parts of the occiput, and communicates with the cervical and occipital arteries.

teries. Having afterwards reached the great foramen of the Os Occipitis, it enters the cranium, and pierces the dura mater; and on these accounts it may be named *arteria occipitalis posterior*, to distinguish it from the other which is lateral.

98. As soon as it enters the cranium, it sends several small ramifications to the back part of the medulla oblongata, and to the corpora olivaria and pyramidalia, which are likewise spread on the backsides of the fourth ventricle of the brain, and form the plexus choroides of the cerebellum.

99. Afterwards it advances on the apophysis basilaris of the Os Occipitis, inclining by small degrees toward the vertebral artery of the other side, all the way to the extremity of that apophysis, where they both join in one common trunk, which may be named *arteria basilaris*.

100. The arteria basilaris runs forward under the great transverse protuberance of the medulla oblongata, to which it gives ramifications, as well as to the neighbouring parts of the medulla. Sometimes this artery divides again near the extremity of the apophysis basilaris into two lateral branches, which communicate with the posterior branches of the two internal carotides, and are lost in the posterior lobe of the brain.

*Arteria basilaris.*

101. The spinal arteries are two in number, one anterior, and one posterior; both produced by both vertebrales, each of which, as soon as it enters the cranium, sends out a small branch, by the union of which, the posterior spinalis is formed. Afterwards the vertebrales advancing on the apophysis basilaris, or production of the occipital bone, detach backward two other small branches, which likewise meet, and by their union form the spinalis anterior. These spinal arteries run down on the fore and back sides of the medulla spinalis, and, by small transverse ramifications, communicate with those which the intercostal and lumbar arteries send to the same part.

*Arterie spinales.*

102. The internal auditory artery goes off from each side of the arteria basilaris, to the organ of hearing, accompanying the auditory nerve, having first furnished several small twigs to the membrana arachnoides.

*Arteria auditoria interna.*

103. The



*Arteria meningea posterior.*

103. The posterior meningea arises from the same trunk with the auditoria interna, and goes to the back part of the dura mater, on the occipital and temporal bones, and likewise supplies the neighbouring lobes of the brain.

*Arteria intercostalis superior.*

104. When the superior intercostal artery does not go out from the trunk of the aorta descendens, it commonly arises from the lower side of the subclavian, and runs down on the inside of the two, three, or four uppermost true ribs, near their heads, and sends off under each rib, a branch which runs along the lower edge, and supplies the intercostal muscles and neighbouring parts of the pleura.

105. These branches or particular intercostal arteries communicate with each other at different distances by small rami, which run upward and downward from one to the other, on the intercostal muscles.

106. They likewise give branches to the muscoli sterno-hyoidæi, subclavius, vertebrales, and bodies of the vertebræ; and also to the pectoralis major and minor, piercing the intercostal muscles; and lastly, they send branches through the notches of the first four vertebræ to the medulla spinalis and its coverings.

107. Sometimes the superior common intercostal artery comes from the cervicalis, and not immediately from the subclavia. Sometimes it arises from the aorta descendens, either by small separate arteries, or by a common trunk, which divides as it runs obliquely up upon the ribs. Lastly, it sometimes arises from the nearest bronchialis, or from several bronchiales together.

108. The ductus arteriosus, which is found only in the foetus and in very young children, arises from the aorta descendens immediately below the left subclavian artery. In adults, this duct is shrunk up and closed, and appears only like a short ligament, adhering by one end to the aorta, and by the other to the pulmonary artery, so that in reality it deserves no other name than that of *ligamentum arteriosum*.

*Arteria bronchialis.*

109. The bronchial arteries go sometimes from the foreside of the superior descending aorta, sometimes from the first intercostal, and sometimes



sometimes from the arteria œsophagæa. Sometimes they arise separately from each side, to go to each lung, and sometimes by a small common trunk, which afterwards separates towards the right and left hand, at the bifurcation of the aspera arteria, and accompany the ramifications of the bronchia.

110. The bronchial artery on the left side often comes from the aorta, while the other arises from the superior intercostal on the same side, which variety is owing to the situation of the aorta. Sometimes there is another bronchial artery which goes out from the aorta posteriorly, near the superior intercostal, above the bronchialis anterior.

111. In the year 1719, I observed a very plain communication of the branches of the left pulmonary vein, with the ram. of an arteria œsophagæa, which came from the first left intercostal, together with the bronchial artery of the same side.

112. The bronchialis gives a small branch to the neighbouring auricle of the heart, which communicates with the arteria coronaria.

113. In the year 1719 or 1720, I discovered a communication between the left bronchial artery and the vena azygos; and in the month of August 1721, I saw a branch of this bronchial artery joined by an anastomosis to the body of the azygos.

114. The œsophagææ are generally two or three in number, sometimes but one. They arise anteriorly from the aorta descendens, and are distributed to the œsophagus, &c. Sometimes the uppermost œsophagæa produces a bronchial artery.

*Arteria œsophagæa.*

115. The inferior intercostals are commonly seven or eight on each side, and sometimes ten, when the superior intercostals arise likewise from the aorta descendens; in which case these run obliquely upward, as has been already said.

*Arteria intercostales inferiores.*

116. They arise along the backside of the descending aorta in pairs, all the way to the diaphragm, and run transversely towards each side, on the bodies of the vertebræ. Those on the right side pass behind the vena azygos; and afterwards they all run to the intercostal muscles, along the lower edge of the ribs, all the way to the sternum or near it.

117. They send branches to the pleura, to the vertebral muscles, to those muscles which lie on the outsides of the ribs, and to the upper portions of the muscles of the abdomen; and they communicate with the arteriæ epigastricæ and lumbares.

118. Sometimes instead of going out from the aorta in pairs, they arise by small common trunks, which afterwards divide, and send an artery to each neighbouring rib.

119. Before they take their course along the ribs, each of them detaches one branch between the transverse apophyses on both sides, to the vertebral muscles, and another which enters the great canal of the spina dorſi. Each of these latter branches divides at least into two small arteries, one of which runs transversely on the anterior side of the canal, the other on the posterior side. Both of them communicate with the like arteries from the other side of the spine, in such a manner, as to form a kind of arterial rings, which likewise communicate with each other by other small ramifications. The same is to be observed in the arteriæ lumbares.

120. Afterwards each intercostal artery having reached the middle of the rib or a little more, divides into two principal branches, one internal, the other external. Soon after this division, the arteries that run upon the false ribs, separate a little from them, being gradually bent downward one after another, and are spread upon the abdominal muscles. They are likewise distributed to other neighbouring muscles, and particularly to those of the diaphragm, almost in the same manner with the arteriæ phrænicæ, they also communicate with the lumbares, and sometimes with branches of the hypogastricæ.

121. The subclavian artery having left the thorax immediately above the first rib, in the interstice left between the portions of the scalenus, there receives the name of *axillaris*, because it passes under the axilla.

122. In this course it gives off from its inside, a small branch to the inside of the first rib; and afterwards four or five principal branches, viz. the thoracica superior or mammaria externa, thoracica inferior, muscularis or scapularis externa, scapularis interna, and humeralis.

123. The superior thoracica or external mammary artery, runs

runs down in a winding course on the lateral parts of the thorax, and crosses the ribs. It gives branches to the two pectoral muscles, to the mamma, musculus subclavius, serratus major, latissimus dorsi, and to the upper portions of the coraco-brachialis and biceps. *Arteria thoracica superior.*

124. These branches are sometimes separate for some space; and one of them in particular runs down between the deltoides and pectoralis major, together with the vena cephalica to which it adheres very closely, the extremity of it piercing the coat of that vein, as if there were an anastomosis between them. Another sometimes runs between the musculus brachialis and anconæus internus, which communicates with a branch of the radial artery.

125. The inferior thoracic artery runs along the inferior costa of the scapula, to the musculus subscapularis, teres major and minor, infra-spinatus, latissimus dorsi, serratus major, and the neighbouring intercostal muscles, communicating with the arteriæ scapulares. *Arteria thoracica inferior.*

126. The external scapular artery passes through the notch in the superior costa of the scapula, to the musculus supra-spinatus and infra-spinatus, teres major and minor, and to the articulation of the scapula with the Os Humeri. *Arteria scapulares.*

127. The internal scapularis arises from the axillary artery near the axilla, and runs backward, to be distributed to the subscapularis, giving branches to the serratus major, to the axillary glands, and to the teres major, upon which it is ramified in different manners. It likewise sends rami to the infra-spinatus and upper portion of the anconæi.

128. The humeral artery arises from the lower and fore-side of the axillaris, and runs backward between the head of the Os Humeri and teres major, surrounding the articulation, till it reaches the posterior part of the deltoides to which it is distributed. *Arteria humeralis.*

129. During this course, it gives several branches to the superior portions of the anconæi, to the capsular ligament of the joint of the shoulder, and to the Os Humeri itself through several holes immediately below the great tuberosity of the



head of that bone. It likewise communicates with the scapular artery.

130. Opposite to the origin of this humeral artery, the axillaris sends off another small branch, which runs in a contrary direction between the head of the Os Humeri and the common upper part of the biceps and coraco brachialis; and having given branches to the vagina and channel of the biceps, and to the periosteum, afterwards joins the principal humeralis.

131. The axillary artery having given off these branches, passes immediately behind the tendon of the pectoralis major, where it changes its former name for that of *arteria brachialis*. It runs down on the inside of the arm over the musculus coraco-brachialis, and anconæus internus, and along the inner edge of the biceps behind the vena basilica, giving small branches on both sides to the neighbouring muscles, to the periosteum, and to the bone.

132. Between the axilla and middle of the arm, it is covered only by the skin and fat; but afterwards it is hid under the biceps, and runs obliquely forward as it descends; being at some distance from the internal condyle, but it does not reach the middle of the fold of the arm.

133. Between the axilla and this place, it sends off many branches to the infra-spinatus, teres major and minor, subscapularis, latissimus dorsi, serratus major, and other neighbouring muscles, to the common integuments, and even to the nerves. Below the fold of the arm, it divides into two principal branches, one called *arteria cubitalis*, the other *radialis*.

134. From its upper and inner part, it sends off a particular branch, which runs obliquely downward and backward over the anconæi, and then turns forward again near the external condyle, where it communicates with a branch of the *arteria radialis*.

135. Immediately below the insertion of the teres major, it gives off another branch, which runs from within outwards, and from behind forward, round the Os Humeri; and descends obliquely forward, between the musculus brachæus, and anconæus externus, to both which it is distributed in its passage. Having afterwards reached the external condyle,



condyle, it unites with the branch last mentioned, and likewise communicates with a branch of the arteries of the fore-arm, so that there is here a triple anastomosis.

136. About the breadth of a finger below this second branch, the brachial artery sends off a third, which runs down toward the internal condyle, and communicates with other branches of the arteries of the fore-arm, as we shall see hereafter.

137. About the middle of the arm, or a little lower, much about the place where the brachial artery begins to be covered by the biceps; it sends off a branch, which is distributed to the periosteum, and penetrates the bone, between the *musculus brachii* and *anconæus internus*.

138. About an inch lower, it gives off another branch, which having furnished ramifications to the *anconæus internus*, runs over the inner condyle, and likewise communicates with branches of the arteries of the fore-arm.

139. Having got below the middle of the arm, the brachial artery detaches another branch which runs behind the inner condyle in company with a considerable nerve; and having passed over the muscles inserted in this condyle, it communicates with that branch of the cubital artery, which encompasses the fold of the arm.

140. A little lower it sometimes sends out another branch which passes on the fore-side of the inner condyle, and then communicates with a branch which runs up from the cubital artery. These three communicating branches are termed *collateral arteries*.

141. The common trunk of the brachial artery having reached the fold of the arm, runs together with a vein and a nerve immediately under the aponeurosis of the biceps, and passes under the *vena mediana*, detaching branches on each side to the neighbouring muscles.

142. About a large finger's breadth beyond the fold of the arm, this artery divides into two principal branches, one inner or posterior, named *cubitalis*; the other outer or anterior, named *radialis*, as has been already said.

143. From this bifurcation, the brachial artery sends branches on each side, to the *supinator longus*, *pronator teres*, fat and skin. It sometimes, though very rarely happens, that this artery is divided from its origin into two large branches,

es, which run down on the arm, and afterwards on the forearm, where they have the names of *cubitalis* and *radialis*.

144. The cubital artery sinks in between the ulna, and the upper parts of the pronator teres, perforatus ulnaris gracilis, and radialis internus; then leaving the bone, it runs down between the perforatus and ulnaris internus, all the way to the carpus and great transverse ligament. In this course it winds and turns several ways, and sends out several branches.

145. The first is a small artery which runs inward to the inner condyle, and then turns upward like a kind of recurrent, to communicate by several branches with the collateral arteries of the arm already mentioned, and particularly with the third. A little lower down, another small branch goes off, which having run upward a little way, and almost surrounded the articulation, communicates with the second collateral artery of the arm, between the olecranon and inner condyle.

146. Afterwards, the cubital artery having, in its course between the heads of the ulna and radius, reached the interosseous ligament, sends off two principal branches, one internal, the other external, which I call the *interosseous arteries* of the fore-arm.

147. The external artery pierces the ligament about three fingers breadth below the articulation; and presently afterward gives off a branch, which runs up like a recurrent toward the external condyle of the Os Humeri under the ulnaris externus, and anconæus minimus, to which it is distributed, as also to the supinator brevis; and it communicates with the collateral arteries of the arm on the same side.

148. Afterward this external interosseous artery runs down on the outside of the ligament, and is distributed to the ulnaris externus, extensor digitorum communis, and to the extensores pollicis indicis and minimi digiti; communicating with some branches of the internal interosseous artery.

149. Having reached the lower extremity of the ulna, it unites with a branch of the internal interosseous artery, which at this place runs from within outward, and is distributed together with it on the convex side of the carpus and back of the hand, communicating with the arteria radialis, and with a branch of the cubitalis, which will be mentioned hereafter.

150. By

150. By these communications, this artery forms a sort of irregular arch, from whence branches are detached to the external interosseous muscles, and to the external lateral parts of the fingers.

151. The internal interosseous artery runs down very close to the ligament, till it reaches below the pronator teres, between which and the pronator quadratus, it perforates the ligament, and goes to the convex side of the carpus and back of the hand, where it communicates with the external interosseous artery, with the radialis and internal branches of the cubitalis.

152. From the origin of the two interosseæ, the cubital artery runs down between the perforatus, perforans, and ulnaris internus along the ulna, sending branches to the neighbouring parts. Below the internal interossea, it sometimes sends off a branch which runs down between the flexor pollicis, radialis internus, and perforatus, to which it is distributed all the way to the carpus, where it runs under the internal annular ligament, and communicates on the hand with branches of the arteria radialis.

153. Afterward the cubital artery passes over the internal transverse ligament of the carpus, by the side of the Os Pisiforme, and having furnished the skin, palmaris brevis, and metacarpus, it slips under the aponeurosis palmaris, giving off one branch to the hypothenar minimi digiti, and another which runs towards the thumb between the tendons of the flexors of the fingers, and the bases of the metacarpal bones.

154. It likewise sends off a branch, which running between the third and fourth bones of the metacarpus, reaches to the back of the hand, where it communicates with the external interosseous artery. Afterwards having supplied the interosseous muscles, it communicates with the radialis; and they both form an arterial arch in the hollow of the hand, in the following manner.

155. The cubitalis having got about two fingers breadth beyond the internal annular ligament of the carpus, forms an arch, the convex side of which is turned to the fingers, and commonly sends off three or four branches. The first goes to the inner and back part of the little finger; and is sometimes a continuation or production of that branch which goes to the hypothenar.

156. The



156. The other three branches run in the interstices of the four metacarpal bones, near the heads of which, each of them is divided into two branches, which pass along the two internal lateral parts of each finger, from the fore-side of the little finger to the posterior side of the index inclusively; and at the ends of the fingers, these digital arteries communicate and unite with each other.

157. Sometimes the arch of the cubital artery terminates by a particular branch in the middle finger, and in that case it communicates with the radial artery which makes up what the other wants.

158. This arch sends likewise from its concave side towards the second phalanx of the thumb, a branch for the lateral internal part thereof, and then ends near the head of the first metacarpal bone, by a communication with the radialis, having first given a branch to the fore-side of the index, and another to the side of the thumb next the former. These communicate at the ends of the fingers with the neighbouring branches, as in the other fingers.

159. This arch sends likewise small twigs to the interosseous muscles, to the lumbricales, palmaris, and to other neighbouring parts; and lastly to the integuments.

160. The radial artery begins by detaching a small branch which runs upward like a recurrent, toward the fold of the arm, and turns backward round the external condyle, communicating with the neighbouring branches from the trunk of the brachial artery, especially with the first collateral branch on that side.

161. It runs down along the inside of the radius, between the supinator longus, pronator teres, and the integuments, giving branches to these muscles, and likewise to the perforatus, perforans, and supinator brevis. From thence it runs in a winding course toward the extremity of the radius, supplying the flexors of the thumb and pronator quadratus.

162. Having reached the extremity of the radius, it runs nearer the skin, especially toward the anterior edge of the bone, being the artery which we there feel when we examine the pulse.

163. At the end of the radius, it gives off a branch to the thenar; and after having communicated with the arch of the cubital artery in the palm of the hand, and sent off some cutaneous



cutaneous branches at that place, it detaches one along the whole internal lateral part of the thumb.

164. Afterwards it runs between the first phalanx and tendons of the thumb, to the interstice between the basis of this first phalanx, and of the first metacarpal bone, where it turns toward the hollow of the hand.

165. At this turning, it sends off a branch to the external lateral part of the thumb, which, having reached the end thereof, communicates by a small arch with the branch which goes to the internal lateral part.

166. It likewise sends branches outward, which run more or less transversely between the first two bones of the metacarpus and the two tendons of the *radialis externus*; and it communicates with an opposite branch of the *cubitalis*, together with which it furnishes the external interosseous muscles and integuments of the back of the hand and convex side of the carpus.

167. Lastly, the radial artery terminates, in its passage over the semi interosseous muscle of the index, near the basis of the first metacarpal bone, and as it runs under the tendons of the flexor muscles of the fingers, where it is joined to the arch of the *cubitalis*.

168. It sends off another branch which runs along the fore-part of the first bone of the metacarpus, to the convex side of the index, where it is lost in the integuments.

169. It gives likewise a branch to the internal lateral part of the index, which, at the end of that finger, joins an opposite branch which comes from the arch of the *cubitalis*. It also sends off a small branch cross the internal interosseous muscles, where it forms a kind of small irregular arch, which communicates with the great arch by several small arterial rami.

170. When the arch of the *cubitalis* ends at the middle finger, the *radialis* runs along the inner or concave part of the first metacarpal bone, at the head of which it terminates by two branches.

171. One of these branches runs along the inner and anterior lateral part of the index; the other passes between the flexor tendons of this finger and the metacarpal bone, and having communicated with the cubital branch of the middle finger, it advances on the posterior lateral part of the index

all the way to the end of that finger, where it unites again with the first branch.

172. The left diaphragmatic artery goes out commonly from the aorta descendens, as it passes between the crura of the small muscle of the diaphragm. *Arteria diaphragmatica.* The right diaphragmatic comes sometimes from the nearest lumbar artery, but most commonly from the cæliaca. Sometimes both these arteries arise by a small common trunk immediately from the aorta. They likewise have the name of *arteriæ phrenicæ*.

173. They appear almost always in several ramifications on the concave or lower side of the diaphragm, and seldom on the upper or convex side. They give small branches to the glandulæ renales or capsulæ atrabiliaræ, which sometimes communicate with the other arteries that go to the same part.

174. They send likewise small branches to the fat which lies upon the kidneys, called the *membrana adiposa*, from whence they have the name of *arteriæ adiposæ*; and they sometimes come immediately from the trunk of the aorta on one side of the mesenterica superior.

175. Besides these capital diaphragmatic arteries, there are others of a subordinate class, which come from the intercostales, mammariæ internæ, mediastinæ, pericardiæ, and cæliaca, as is observed in the description of each of these arteries.

176. The celiac artery rises anteriorly and a little to the left hand, from the aorta descendens, immediately after its passage through the small muscle of the diaphragm, nearly opposite to the cartilage between the last vertebra of the back and first of the loins. The trunk of this artery is very short; and near its origin, it sends off from the right side two small diaphragmaticæ, though sometimes there is only one which goes to the right hand, and is afterwards distributed both ways; communicating with the other arteries of the same name which come from the intercostales and mammariæ. The left branch sends rami to the superior orifice of the stomach and to the glandula renalis on the same side; the right furnishes the pylorus, and the renal gland on the right side.

177. Immediately after this, the cæliaca gives off a considerable

considerable branch, named *arteria ventriculi coronaria*, and *gastrica*, or *gastrica superior*; and then it presently divides into two large branches, one toward the right hand, named *arteria hepatica*; the other to the left, called *splénica*, which is larger than the former.

178. Sometimes this artery is divided into these three branches at the same place, very near its origin; the trunk going out from the aorta almost in a straight line, and the branches from the trunk almost at right angles, like radii from an axis, whence this trunk has been called *axis arteriæ celiacæ*.

179. The coronary artery of the stomach goes first to the left side of that organ, a little beyond the superior orifice; round which orifice it throws branches, and also to every part of the stomach near it; and these branches communicate with those which run along the bottom of the stomach to the pylorus.

*Arteria ventriculi coronaria.*

180. Afterwards it runs on the right side of the superior orifice, along the small curvature of the stomach, almost to the pylorus, where it communicates with the *arteria pylorica*; and turning towards the small lobe of the liver, it gives off some branches to it.

181. Then it advances, under the ductus venosus, to the left lobe of the liver, in which it loses itself near the beginning of the just-mentioned duct, having first given off some small branches to the neighbouring parts of the diaphragm and omentum.

182. As soon as the hepatic artery leaves the *celiaca*, it runs to the upper and inner part of the pylorus, in company with the *vena portæ*, sending off two branches, a small one called *arteria pylorica*, and a large one named *gastrica dextra*, or *gastrica major*.

*Arteria hepatica.*

183. The *pylorica* is ramified on the pylorus, from whence it has its name; and having distributed branches to the neighbouring parts of the stomach, which communicate with those of the right *gastrica*, it terminates on the pylorus, by an anastomosis with the coronary artery of the stomach.

184. The right gastric artery having passed behind and beyond the pylorus, sends out a considerable branch named *arteria duodenalis*, or *intestinalis*, which sometimes comes

from the trunk of the hepatica, as we shall see hereafter. Afterwards this gastric artery runs along the right side of the great curvature of the stomach, to the neighbouring parts of which, on both sides, it distributes branches.

185. These branches communicate with those of the arteria pylorica, and of the coronaria ventriculi, and with the right gastro-epiploicæ, which furnish the nearest parts of the omentum, and communicate with the mesenterica superior. After this, the right gastric artery ends in the left, which is a branch of the splenica.

186. The duodenal or intestinal artery runs along the duodenum on the side next the pancreas; to both which it furnishes branches, and also to the neighbouring part of the stomach. Sometimes this artery goes out from the mesenterica superior, and sometimes it is double.

187. The hepatic artery having sent out the pilorica and right gastrica, advances behind the ductus hepaticus, toward the vesicula fellis, to which it gives two principal branches called *arteriæ cysticæ*; and another named *biliaria*, which is lost in the great lobe of the liver.

188. Afterwards, this artery enters the fissure of the liver, and joins the vena portæ, with which it runs within a membranous vagina called *capsula glissoni*, and accompanies it through the whole substance of the liver by numerous ramifications, which may be termed *arteriæ hepaticæ propriæ*.

189. Before it enters the liver, it gives small branches to the external membrane of this viscus, and to the capsula glissoni. The gastric and proper hepatic arteries come sometimes from the mesenterica superior, when the ordinary ramifications are wanting.

190. Immediately after the origin of the splenic artery from the cæliaca, it runs toward the left hand, under the stomach and pancreas, to the spleen. It adheres closely to the posterior part of the lower side of the pancreas, to which it gives several branches named *arteriæ pancreaticæ*.

191. Near the extremity of the pancreas, under the left portion of the stomach, the splenic artery gives off a principal branch called *gastrica sinistra* or *minor*, which runs from left to right along the left portion of the great curvature of the stomach, giving branches to both sides of this portion, which communicate with those of the coronaria ventriculi.

192. This



192. This gastric artery sends likewise another branch at least to the extremity of the pancreas, which communicates with the other pancreatic arteries. It also supplies the omentum with branches, termed *gastro-epiploicæ sinistre*; and then it communicates with the right gastrica, and from this union, the *gastro-epiploicæ mediæ* are produced.

193. From this detail we learn that the *arteria coronaria ventriculi pylorica, intestinalis*, both *gastricæ*, *gastro-epiploicæ*, and consequently the *hepatica, splenica*, and *mesenterica*, communicate all together.

194. Afterwards, the splenic artery advances towards the spleen, in a course more or less contorted; but before it arrives at that viscus, it gives two or three branches to the large extremity of the stomach, commonly called *vasa brevia*; and one to the omentum, named *epiploica*.

195. At the spleen, this artery divides into four or five branches, which enter that viscus, after having given some small twigs to the neighbouring parts of the stomach and omentum.

196. The superior mesenteric artery arises anteriorly from the lower portion of the descending aorta, a very little way below the *cæliaca*, going out a little towards the right hand, but bending immediately afterwards to the left.

*Arteria mesenterica superior.*

197. Near its origin, it gives off a small branch, which dividing into two, goes to the lower side of the head of the pancreas, and neighbouring part of the duodenum, communicating with the *intestinalis* by small arches, and *areolæ* or meshes.

198. Afterwards it passes over the duodenum, between this intestine and the meseraic vein, between the two laminae of the mesentery; and then bending in an oblique direction from left to right, and from above downward, by very small degrees, it advances toward the extremity of the ilium. By this incurvation, it forms a kind of long arch, from the convex side of which a great many branches go out.

199. These branches are sixteen or eighteen in number, or thereabouts, and almost all of them are bestowed on the small intestines, from the lower third part of the duodenum to the *cæcum* and colon. The first branches are very short, and from thence they increase gradually in length all the

way

way to the middle of the arch; the rest diminishing again by small degrees.

200. As they approach the intestines, all these branches communicate first by reciprocal arches; then by areolæ and meshes of all kinds of figures, from which is detached an infinite number of small ramifications, which surround the intestinal canal, like an annular piece of net-work.

201. These arches and meshes increase in number proportionably to the length of the branches; and their size diminishes gradually as they approach the intestines.

202. The first branches from the convex side of the mesenteric arch, which are very short, supply the pancreas and mesocolon, and communicate with the duodenal artery. The last branches go to the appendicula vermiformis, and send a portion of an arch to the beginning of the colon.

203. The considerable branches from the concave side of the mesenteric arch, are seldom above two or three in number; but before they arise, a small ramus goes out to the duodenum, and gives some very small arteries to the pancreas.

204. The first considerable branch from the concave side of the arch, goes into the mesocolon towards the right portion of the colon, being first divided into two rami; the first of which runs along the whole superior part of the colon, where it forms the famous communication with the mesenterica inferior; and might be named *arteria colica superior*. The other ramus of this branch runs down on the right portion of the colon.

205. The second principal branch having run for some space through the mesentery, divides into three rami; the first of which goes to the lower part of the right portion of the colon, where it communicates with the second ramus of the first branch, the second goes to the beginning of the colon, where it communicates with the first, and to the intestinum cæcum.

206. The third ramus of this second branch, having communicated with the second, gives small twigs to the cæcum; appendicula vermiformis, and extremity of the ileum. Afterwards it communicates with the extremity of the arch, or curve trunk of the superior mesenteric.

207. All these communications are by arches and meshes;

as in those branches that come from the convex side of the arch; and it is to be observed in general, that all the branches of the mesenterica superior are disposed according to the folds of the mesentery and circumvolutions of the intestines; giving off branches, through their whole course, to the laminæ of the mesentery, its cellular substance, and to the mesenteric glands.

208. The lower mesenteric artery goes out anteriorly from the aorta descendens inferior, about a finger's breadth or more above the bifurcation, and below the spermatic arteries; and having run about the length of an inch, or something more, it is divided into three or four branches, which gradually separate from each other.

*Arteria mesenterica inferior.*

209. The first or superior branch, about an inch from its origin, divides into two rami; the first of which runs along the left portion of the colon, and forms the communication of the two mesenteric arteries already mentioned. It may be named *arteria colica sinistra*. The second ramus having communicated with the first, runs down upon the same portion of the colon.

210. The middle branch having run the same length with the first, divides into two rami; one of which passes upward on the extremity of the colon, communicating by arches with the second ramus of the superior branch; the other runs down on the extremity of the same intestine.

211. When there is another middle branch, it goes to the first part of the double curvature of the colon, by a like distribution and communication from above downward.

212. The lower branch goes to the second portion of the colon, or to both, when the second middle branch is wanting, and sends up a ramus, which communicates with the foregoing.

213. It sends another considerable branch downward, called *arteria hæmorrhoidalis interna*, which runs down behind the intestinum rectum, to which it is distributed by several ramifications, and it communicates with the arteriæ hypogastricæ.

214. The renal arteries, called commonly *emulgents*, are ordinarily two in number, and go out laterally from the inferior descending aorta, immediately

*Arteriæ renales.*

ately

ately under the mesenterica superior, one to the right hand, the other to the left. The right is situated more backward, and is longer than the left, because of the vena cava, which lies on the right side between the aorta and the kidney.

215. They run commonly without division, and almost horizontally to the kidneys, into the depressions of which they enter by several branches, which form arches in the inner substance of these viscera.

216. From these arches, numerous small rami go out toward the circumference or outer surface of the kidneys. Sometimes there is more than one artery on each side; sometimes this augmentation is only on one side, and these supernumerary arteries come sometimes immediately from the aorta, and enter at the upper or lower part of the kidneys.

217. Ordinarily, the right renal artery passes behind the vena cava and renal vein on the other side; and the left artery, first behind and then before the vein. Sometimes they send branches to the glandulæ renales, membrana adiposa of the kidneys, and even to the diaphragm.

218. The arteries of the renal glands, which may be termed *arteriæ capsulares*, arise sometimes from the aorta above the arteria renalis, and give out the *arteriæ adiposæ*, which go to the fat of the kidneys. Sometimes they come from the trunk of the cæliaca. The right capsular artery comes most commonly from the arteria renalis of the same side, near its origin; the left from the aorta above the renalis.

219. The spermatic arteries are commonly two in number, sometimes more. They are very small, and go out anteriorly from the aorta descendens inferior, near each other, about a finger's breadth below the arteriæ renales, more or less, between the two mesentericæ, or between the renales and mesentericæ inferiores. Sometimes one is higher, or placed more laterally than the other.

220. They send off to the common membrane of the kidneys, small branches named *arteria adiposa*; and afterwards they run down upon the psoas muscles, on the fore-side of the ureters, between the two laminæ of the peritonæum.

221. They give several considerable branches to the peritonæum;



tonæum, chiefly to those parts of it which are next the mesentery, and they communicate both with the mesenterica and adiposa. They likewise send small arteries to the ureters.

222. Afterwards, they pass in men, through the tendinous openings of the abdominal muscles in the vagina of the peritonæum, and are distributed to the testicles and epididymis, where they communicate with a branch of the iliaca externa.

223. In women they do not go out of the abdomen, but are distributed to the ovaria and uterus, and communicate with branches of the hypogastrica, at the jagged extremities of the tubæ Fallopiæ.

224. The lumbar arteries go out posteriorly from the inferior descending aorta, in *Arteriæ lumbares.* five or six pairs, or more, much in the same manner with the intercostals.

225. They may be divided into superior and inferior. The superior send small branches to the neighbouring parts of the diaphragm and intercostal muscles, and supply the place of semi-intercostal arteries. Sometimes those pairs go out by a small common trunk, and not separately.

226. They are distributed on each side to the psoas muscles, to the quadrati lumborum, and to the oblique and transverse muscles of the abdomen; and by perforating the oblique muscles, they become external hypogastric arteries. They go likewise to the vertebral muscles, and to the bodies of the vertebræ, and enter the spinal canal through the lateral notches, to go to the membranes, &c. forming rings much in the same manner with the intercostals; and they likewise give small twigs to the nerves.

227. The arteriæ sacrae go out commonly from the back part of the inferior descending aorta, at the bifurcation. Sometimes they arise higher, *Arteriæ sacrae.* from the lumbares, and sometimes lower, from the iliacæ. They are two, three, or four in number, and sometimes but one. They are ramified on the Os Sacrum, and on the neighbouring parts of the peritonæum, intestinum rectum, fat, &c.; and enter the canal of that bone through the anterior holes, being there distributed toward each side. They likewise send small arteries to the large fasciculi of nerves

which go out through the holes of the Os Sacrum, and they penetrate the inner substance of that bone,

228. The inferior descending aorta ends at the last vertebra of the loins, and sometimes higher, in two large lateral branches, one on the right hand, the other on the left, called *arteriæ iliacæ*; each of which is a common trunk to two other arteries of the same name. This bifurcation lies on the anterior and left side of that of the vena cava.

229. The primitive iliac arteries divaricate gradually as they descend, advancing obliquely toward the anterior and lower part of the *Ossa Ilium*, without any considerable ramification for about the breadth of three fingers, except a few very small arteries that go to the Os Sacrum some of which enter by the upper holes, and are distributed like the *arteriæ sacrae*, while others emerge again through the posterior holes, and go to the neighbouring muscles, &c. They likewise give small arteries to the peritonæum, to the coats of the veins, and to the fat and ureters, behind which the iliac trunks pass.

230. The right iliac trunk passes first, on the fore-side of the origin of the left iliac vein, and runs down on the fore-side of the right vein, almost to the place where it goes out of the abdomen, its course being there directed more inwardly. The left trunk goes down likewise before the left vein, but lies a little toward the inside as it leaves the abdomen.

231. About three fingers breadth from their origin, each iliac trunk is divided into two secondary arteries, one external, the other internal. The external artery has no particular name; the internal is termed *hypogastrica*, which often appears to be no more than a branch of the other, in adults; but in young children, and especially in the foetus, the hypogastric artery looks like the trunk, and the other like a branch.

232. The external iliaca on each side runs down on the iliac muscle to the ligamentum Falloppii, under which it goes out of the abdomen. In this course, it gives off only a few small arteries, to the peritonæum and other parts near it; but as it passes out of the abdomen under the ligament, it detaches two considerable branches, one internal, the other external.

233. The

233. The internal branch is named *arteria epigastrica*, and goes out anteriorly from the external iliaca. From thence it runs obliquely upward on the tendon of the transverse muscle toward the posterior part of the rectus, which it reaches about two or three fingers breadth above the Os Pubis.

234. Afterwards the epigastric artery runs up along the posterior or inner side of this muscle, sending ramifications to the tendons of the neighbouring muscles, &c.; and then loses itself by a true anastomosis of several ramifications, with the *mammaria interna*. It likewise communicates with the inferior intercostals, which are spread on the abdomen.

235. It sometimes gives out two particular branches, one of which accompanied by a nerve, goes through the foramen ovale of the pelvis to the triceps muscles, &c.; the other runs down to the testicles along with the spermatic artery, and there communicates with it.

236. The external branch of the outer iliaca goes off laterally from the outside of that artery under the *ligamentum Falloppii*, and from thence to the internal labium of the Os Ilium, where it divides into two, and is ramified on the oblique and transverse muscles of the abdomen, communicating with the *arteria lumbaris*.

237. Besides these two branches, the external iliaca gives off a small ramus internally under the ligament, which runs to the vagina of the spermatic rope; and sometimes another small twig goes from the outside to the Os Ilium.

238. The internal iliaca or *hypogastrica*, having run a little more than a finger's breadth inward and backward, bends by small degrees obliquely forward, and toward the outside; and, afterwards contracting in its dimensions, it ends in the umbilical artery, which ought to be looked upon as a true continuation of the trunk of the *hypogastrica*.

239. This *arteria umbilicalis* ascends on the side of the bladder, and having detached small rami to that viscus and to the neighbouring parts of the peritonæum, &c. it contracts, and in adults is quite closed up, above the middle of the bladder. It likewise gives branches to the uterus, and to the neighbouring parts in both sexes. Afterwards it ascends in form of a ligament to the umbilicus, where it joins the umbilical artery on the other side; its name being taken from its use in the foetus.



240. From the convex side of the curvature of the hypogastric artery, four or five principal branches commonly go out very near each other. Sometimes they all arise separately, sometimes by small common trunks, and what is the first branch in some subjects, is only a ramus of another principal branch in others; so much does the number, disposition, origin, and distribution of these branches vary in different subjects. For this reason I think it proper to distinguish them by the following proper names; *iliaca minor*, *glutæa*, *sciatica*, *pudica communis sive pudica hypogastrica*, and *obturatrix*.

241. The *iliaca minor*, the most posterior of these branches, and which is often no more than a ramus of the *glutæa*, passes between the last two lumbar nerves, and divides into two rami, one of which enters the canal of the Os Sacrum through the lowest large anterior holes; the other passes behind the musculus psoas to which it gives twigs, and behind the crural nerve, being afterwards distributed to the iliac muscle, and to the middle part of the inside of the Os Ilium, penetrating into the substance of the bone sometimes by one hole sometimes by more.

242. The *arteria glutæa* is commonly very considerable, and sometimes the largest of all the hypogastric branches. Near its beginning it sometimes sends out the *iliaca minor*, and sometimes the small ramus that goes from that artery to the Os Sacrum and other parts fixed to that bone. Afterwards this artery goes out of the pelvis in company with the sciatic nerve, thro' the upper part of the great sinus of the Os Innominatum, below the musculus pyriformis, and is distributed in a radiated manner to the *glutæus maximus* and *medius*.

243. In its passage, it gives some branches to the Os Sacrum, Os Coccygis, musculus pyriformis, the muscles of the anus, and to the neighbouring parts of the intestinum rectum, forming a particular hæmorrhoidalis interna. It likewise sends twigs to the bladder and parts near it; and detaches a pretty long branch which runs down with the sciatic nerve.

244. The *arteria sciatica* gives first of all, some branches to the musculus pyriformis, the quadrigemini, the Os Sacrum, &c. and even to the inner side of the Os Ischium. It likewise detaches a branch which runs under the musculus quadratus, to the articulation of the Os Femoris.

245. It



245. It passes obliquely over the sciatic nerve, and as they both go through the great posterior sinus of the Os Ilium, it detaches small arteries which are distributed to the inner substance of that nerve. Afterwards it runs up in a radiated manner on the outside of the Os Ilium, and is distributed to the inner substance of that bone, and to the musculi glutæi, especially to the medius and minimus.

246. The pudica communis, called commonly pudica interna, arises sometimes by a trunk common to it and to the glutæa, and gives out two principal branches; the first of which passes through the great sinus of the Os Ilium in company with the glutæa and sciatica, and then divides into two rami.

247. The first ramus goes behind the spine of the ischium, between the two ligaments which lie between that bone and the Os Sacrum; and runs on the inside of the tuberculum ischii, all the way to the origin of the corpus cavernosum penis. There it divides into several arteries, one of which goes to the sphincter ani, under the name of *hemorrhoidalis externa*.

248. The rest are distributed to the neighbouring integuments, to the bulb of the urethra, and to the corpus cavernosum penis; but the last of these arteries, or rather the extremity of this first ramus, runs from behind forward, over the neck of the Os Femoris, and communicates with a branch of the arteria cruralis.

249. The second principal ramus, called commonly *arteria pudica externa*, runs between the bladder and intestinum rectum, and is distributed in men to the vesiculæ seminales, neck of the bladder, prostate gland, and neighbouring parts of the rectum.

250. Afterwards it runs under the Os Pubis on the side of a considerable vein, which lies directly under the symphysis; and it runs along the penis between this vein and a nerve, being distributed in its passage to the corpus cavernosum, and communicating with the pudica minor, which comes from the cruralis.

251. This second branch of the pudica major goes off sometimes separately from the hypogastrica, especially in women, being distributed to the lateral parts of the uterus, where it communicates with the spermatic artery, near the jagged

jagged extremity of the tuba falloppiana; and to the neighbouring parts of the vagina, &c.

252. The arteria obturatrix perforatus the obturator muscles from whence it has its name, and goes out of the pelvis at the upper part of the ligament of the foramen ovale, having first sent a small branch over the symphysis of the Os Ilium and Os Pubis, to the inguinal glands and integuments.

253. As it passes by the muscles, it divides and is distributed to the pectineus and triceps. It likewise sends out another branch, which communicates with that branch of the sciatica that goes to the articulation of the Os Femoris; and gives small arteries to the holes in the neck of that bone.

254. Afterwards the hypogastric artery ends in the umbilicalis; as has been already said.

255. The iliac artery goes out of the abdomen between the ligamentum Fallopii and tendon of the psoas  
*Arteriæ crurales.* at the union of the Os Ilium and Os Pubis, and there it takes the name of *arteria cruralis*.

256. It sends off first of all, three small branches; one of which called *pudica externa*, goes over the crural vein to the skin and ligament of the penis, and to the inguinal glands, communicating with the *pudica interna*. The second goes to the musculus pectineus; and the third to the upper part of the sartorius. All these branches furnish likewise the neighbouring anterior integuments.

257. Afterwards the crural artery runs down on the head of the Os Femoris, and by taking a particular turn, gets on the inside of the crural vein, about three fingers breadth from where it goes out of the abdomen. From its origin to this place, it is covered only by the skin and fat, and lies on the pectineus and triceps primus.

258. In changing its situation it sends out three considerable branches, one external, one middle, and one internal. They all go out more or less posteriorly, sometimes by a short common trunk, sometimes by two, &c.

259. The external branch runs on the upper side of the thigh to the crureus, vastus externus, rectus anterior, musculus fasciæ latæ, and glutæus medius; sending up a ramus to the apex of the great trochanter, which communicates with the first principal ramus of the *pudica major*, and sciatica, as has been already said.

260. The

260. The middle branch runs high between the triceps and the femur, one whereof perforates the bone, and is distributed to the glutæus maximus, glutæus medius, biceps, and to the neighbouring parts.

261. The internal branch runs backward between the gemini, towards the great trochanter; and gives a ramus which goes into the joint of the Os Femoris, and runs downward, and gives rami to all the muscles on the backside of that bone, one of which enters the bone itself on one side of the linea aspera.

262. Having sent off all these three branches, the arteria cruralis runs down between the sartorius, vastus internus, and triceps, giving branches to all the parts near it. It is covered by the sartorius all the way to the lower part of the thigh, where it is inflected backward over the triceps tertius a little above the internal condyle of the Os Femoris. Afterwards continuing its course through the hollow of the ham, it is called *arteria poplitea*, being accompanied by the vein of the same name.

263. The poplitea while in the ham, is covered only by the integument, sending off branches toward each side, which run up upon the condyles, and communicate with the lower ramifications of the arteria cruralis.

264. It sends rami to the joint of the knee, one of which at least passes between the crucial ligaments. As it runs down, it sends branches to the gastrocnemii and popliteus; and having reached the backside of the head of the tibia, it gives off two branches, one to each side.

265. The first or internal branch surrounds the fore-part of the head of the tibia, passing between the bone and internal lateral ligament; and besides several other ramifications, sends up a small branch which communicates with the arteries that lie round the condyles of the Os Femoris.

266. The second or external branch runs over the head of the fibula, and between the head of the tibia and external lateral ligament of the knee, surrounding the articulation all the way to the ligaments of the patella, and communicating with the branches which lie round the condyles of the Os Femoris, together with a branch of the first or internal ramus.



origin of these two rami, and sends a small artery down on the interosseous ligament, very near the tibia, through a particular hole a little above the fibula bone.

At the tibia ends, it divides into two principal branches, one of which runs between the heads of the tibia and fibula, coming from behind forwards on the interosseous ligament, where it takes the name of *arteria tibialis anterior*. The other branch divides into two others, one internal and one external, called *arteria tibialis posterior*, the other posterior and smallest, named *arteria peronæa posterior*.

269. The tibialis anterior having passed between the heads of the tibia and fibula, sends small branches upward and laterally. The superior branches communicate with those rami of the popliteus which lie round the articulation; and the lateral branches go to the neighbouring parts. Afterwards this tibial artery runs down on the foreside of the interosseous ligament, toward the outside of the tibia, between the musculus tibialis anticus and extensor pollicis.

270. Having run laterally on the tibia for about two thirds of the length of that bone, it passes on the foreside under the common annular ligament, and extensor pollicis, to the articulation of the foot; giving off several rami both to the right and left hand, which communicate laterally with the tibialis posterior and peronæa posterior, so that these two bones are in a manner surrounded by arteries.

271. At the joint of the foot, it sends out branches which run between the astragalus and Os Calcis, being distributed to the articulation and to the bones of the tarsus. The communications are here very numerous on all sides.

272. Having passed the fold of the foot, it sends off toward both sides, other rami, which communicate with the posterior tibialis and peronæa; all these branches making a kind of circles round the tarsus.

273. Afterwards the anterior tibial artery advances on the convex side of the foot, as far as the interstice between the first and second metatarsal bones; between the heads of which, it sends a large branch, which perforates the superior interosseous muscle, and joining the tibialis posterior, forms an arch on the side of the foot.

274. It



274. It likewise sends two or three considerable branches over the other metatarsal bones, which go to the rest of the interosseous muscles, integuments &c. and communicate with each other.

275. Lastly, this artery terminates by two principal branches, one of which goes to the thenar and inside of the great toe; the other is spent upon the outside of the great toe, and the inside of the second toe.

276. The tibialis posterior, called likewise *furalis*, runs down between the solei, tibialis posticus, flexor digitorum communis, and flexor pollicis; giving branches to these muscles, to the tibia, and to the marrow of that bone, through a particular canal in its posterior and upper part.

277. Afterwards it runs behind the inner ancle communicating with the tibialis anterior, and surrounded by the neighbouring veins; and passes to the sole of the foot between the concave side of the Os Calcis and thenar muscle, where it divides into two branches, one large or external, the other small or internal.

278. The great branch, or arteria plantaris externa, passes on the concave side of the Os Calcis obliquely under the sole of the foot, to the basis of the fifth metatarsal bone, and from thence runs in a kind of arch toward the great toe, communicating there with the tibialis anterior, which perforates the interosseous muscles in the manner already said.

279. The convex side of this arch supplies both sides of the last three toes, and the outside of the second toe, forming small communicating arches at the end, and sometimes at the middle of each toe, as in the hand. The concave side of the arch furnishes the neighbouring parts.

280. The small branch, or arteria plantaris interna, having reached beyond the middle of the sole of the foot, is divided into two; one of which goes to the great toe, communicating with the ramus of the tibialis anterior; the other is distributed to the first phalanges of the other toes, communicating with the ramifications from the arch already mentioned.

281. The arteria peronæa runs down on the backside of the fibula, between the soleus and flexor pollicis, to which and to the neighbouring parts it gives rami in its passage.

282. Having reached to the lower third part of the fibula,

it sends off a considerable branch, which runs in between the tibia, and that bone passing between their extremities from behind forward, below the interosseous ligament, and is distributed to the integuments of the tarsus.

283. Lastly, the peronæa continuing its course downward, on the backside of the fibula, as far as the Os Calcis, forms an arch with the tibialis posterior, between the astragalus and the tendo achillis.

284. From thence it runs outward, and a little above the outer angle communicates with the tibialis anterior by an arch, which sends several small ramifications to the neighbouring parts.

285. In this description of the arteries, I have said nothing of the cutaneous anastomoses, which are exceedingly beautiful in the foetus; nor of the frequent and considerable communications of small arteries upon the periosteum, which form a delicate kind of net-work, or rete mirabile.

## S E C T. V.

### *A Description of the Veins.*

*Introduction.* 1. **T**HE blood distributed to all parts of the body by two kinds of arteries, the aorta and arteria pulmonaris, returns by three kinds of veins, called by anatomists *vena cava*, *vena portæ*, and *vena pulmonaris*.

2. The vena cava carries back to the right auricle of the heart, the blood conveyed by the aorta to all the parts of the body, except what goes by the arteriæ coronariæ cordis. It receives all this blood from the arterial ramifications in part directly, and in part indirectly.

3. The vena portæ receives the blood carried to the floating viscera of the abdomen by the arteria cæliaca, and the two mesentericæ, and conveys it to the vena hepatica, and from thence to the vena cava.

4. The vena pulmonaris conveys to the pulmonary sinus, or left auricle of the heart, the blood carried to the lungs by the arteria pulmonaris.

5. To these three veins two others might be added, *viz.* those

those which belong particularly to the heart, and to its auricles, and the sinuses of the dura mater.

6. In describing the general course of the veins, we may either begin by their extremities in all the parts of the body, and end by the trunks carried all the way to the heart, according to the course of the blood; or we may begin by the great trunks, and end by the ramifications and capillary extremities, according to their several divisions and subdivisions.

7. This last method is most convenient, and makes it a very easy matter to pursue the first, whenever we think it proper to do it; and, for these reasons, I have chosen to follow it in this description.

8. We commonly talk of the vena cava in general, as if it were but one vein at its origin, or had but one common trunk; whereas it goes out from the right auricle of the heart by two large separate trunks, in a direction almost perpendicularly opposite to each other, one running upward, called *vena cava superior*, the other downward, called *vena cava inferior*.

*General division  
of the vena cava.*

9. It may however be said, that these two veins have a sort of continuity, or a small portion of a common trunk, fixed to the edges of the right auricle; as if three quarters of the circumference of a large straight tube were cut off, and the edges of a small bladder applied to the edges of the opening thus made in the tube.

10. The right auricle may also be looked upon as a muscular trunk common to these two large veins, and may be called the *sinus* of the vena cava; but in this respect, the name of *sinus pulmonaris* agrees still better to the left auricle.

11. The vena cava superior is distributed chiefly to the thorax, head, and upper extremities, and but very little to the parts below the diaphragm.

12. The vena cava inferior is distributed chiefly to the abdomen and lower extremities, and but very little to the parts above the diaphragm.

13. The ancients called the superior vena cava, *ascendens*, and the inferior, *descendens*, having regard only to the great tubes, and to their division into trunks and branches. Several moderns have retained these names, but in a contrary signification, to accommodate them to the motion of the

blood, which descends by the cava superior, and ascends by the cava inferior.

14. But to shun the mistakes that may happen in reports made of wounds or other diseases, and of what is observed in opening dead bodis, and in other cases of these kinds, it is best to retain the distinction of vena cava superior and inferior.

15. The trunk of each of these two veins sends off, much in the same manner with the arteries, a certain number of principal or capital branches, which are afterward ramified in different manners. Each trunk terminates afterwards by a bifurcation or a division into two subordinate trunks, each of which gives off other principal branches, ending in a great number of small trunks, rami, and ramifications.

16. They have likewise this common to them with the arteries, that the greatest part of the capital branches are in pairs; as well as the subordinate trunks. The ramifications of each subaltern trunk taken by itself, are in uneven numbers, but they make even numbers with those of the other like trunk. The vena azygos and some other small veins, of which hereafter, are exceptions from this rule.

17. Before I go on to the particular description of each of these veins, many of which have proper names, I shall give a general idea of their distribution, and an enumeration of their principal ramifications, in the same manner as I did in the description of the arteries, and for the same reason. But I shall say nothing of the venæ coronariæ cordis, because they are not immediately joined to any other vein, as we shall see in describing the parts of the thorax. I begin by the vena cava superior.

*Vena cava superior.* 18. The superior vena cava runs up from the right auricle of the heart, almost in a direct course, for about two fingers breadth, lying within the pericardium, in the right side of the trunk of the aorta, but a little more anteriorly.

19. As it goes out of the pericardium, it is inclined a little to the left hand, and then runs up about an inch, that is, as high as the cartilage of the first true rib, and a little higher than the curvature of the aorta. At this place it terminates by a bifurcation or division into two large branches



es or subordinate trunks, one of which runs toward the left hand, the other toward the right.

20. These two branches are named *subclaviæ*, as lying behind, and in some measure, under the *claviculæ*, both in the same manner. They are of unequal lengths, because the trunk of the *vena cava* does not lie in the middle of the thorax, but toward the right side, where the left *subclavian* arises as well as the right, and is consequently longest.

21. The trunk of the superior cava from where it leaves the pericardium to the bifurcation, sends out anteriorly several small branches, which sometimes arise separately, and sometimes by small common trunks. These branches are the *vena mediastina*, *pericardica*, *diaphragmatica superior*, *thymica*, *mammæaria interna*, and *trachealis*, the last of which go out sometimes behind the bifurcation.

22. All these small branches from the trunk of the cava superior are termed *dextræ*; and their fellows on the other side called *sinistræ* do not arise from the trunk, because of its lateral situation, but from the left *subclavia*.

23. Posteriorly, a little above the pericardium, the trunk of the superior cava sends out a capital branch called *vena azygos*, or *vena sine pari*, which runs down on the right side of the bodies of the *vertebræ dorsi*, almost to the diaphragm; giving off the greatest part of the *venæ intercostales* and *lumbares superiores*.

24. The two *subclaviæ* run laterally or toward each side, and terminate, as they go out of the thorax, between the first rib and *clavicula*, immediately before the anterior insertion of the *musculus scalenus*.

25. The right *subclavian*, which is the shortest of the two, commonly sends out four capital branches; the *jugularis externa*, *jugularis interna*, *vertebralis*, and *axillaris*, which last is rather a continuation than a branch of the *subclavia*.

26. The left *subclavian* being longer than the right, for the reason already given, gives off first of all the small veins on the left side, answering those on the right side that come from the trunk of the superior cava, *viz.* the *mediastina*, *pericardica*, *diaphragmatica superior*, *thymica*, *mammæaria interna*, and *trachealis*.

27. Next to these small veins, called *sinistræ*, it detaches another

another small branch, called *intercostalis superior sinistra*, and then four large branches like those from the right subclavian, *viz.* the *jugularis externa*, *jugularis interna*, *vertebralis*, and *axillaris*, which are all termed *sinistræ*.

28. The external jugular veins are distributed chiefly to the outer parts of the throat, neck and head; and send a small vein to the arm, named *cephalica*, which assists in forming a large one of the same name.

29. The internal jugular veins go to the internal parts of the neck and head, communicating with the sinuses of the dura mater, and in several places with the external jugular veins.

30. The vertebral veins pass through the holes in the transverse apophyses of the vertebræ of the neck, sending branches to the neck and occiput. They form the *sinus venales* of these vertebræ, and communicate with the sinuses of the dura mater.

31. The axillary veins are continuations of the subclaviæ, from where these leave the thorax, to the axillæ. They produce the *mammariæ internæ*, *thoracicæ*, *scapulares*, or *humerales*, and a branch to each arm, which, together with that from the external jugularis, forms the *vena cephalica*.

32. Afterwards the axillary vein terminates in the principal vein of the arm, called *basilica*; which, together with the *cephalica*, is distributed by numerous ramifications to all the parts of the arm, fore-arm, and hand.

33. The portion of the inferior vena cava contained in the pericardium is very small, being scarcely the twelfth part of an inch on the fore-part, and not above a quarter of an inch on the back-part. From thence it immediately perforates the diaphragm, to which it gives the *venæ diaphragmaticæ inferiores* or *phrenicæ*.

34. It passes next behind the liver, through the great sinus of that viscus, to which it furnishes several branches, termed *venæ hepaticæ*.

35. In this course, it inclines a little toward the *spina dorsæ* and *aorta inferior*, the trunk and ramifications of which it afterwards accompanies in the abdomen, all the way to the *Os Sacrum*; the *arteria cæliaca* and the two *mesentericæ* only excepted.

36. Thus

36. Thus the inferior cava sends out on each side, in the same manner with the aorta, the *venæ adiposæ, renales, spermaticæ, lumbares, and sacræ*. Having reached to the Os Sacrum, it loses the name of cava, and terminating by a bifurcation, like that of the descending aorta, it forms the two *venæ iliacæ*.

37. These iliac veins having given off the *hypogastricæ* with all their ramifications, to the viscera of the pelvis, and to some other external and internal neighbouring parts, go out of the abdomen, under the ligamentum Follopii, and there take the name of *venæ crurales*.

38. Each crural vein sends off numerous ramifications to all the lower extremity; besides the *vena saphena* which goes out near the origin of the *cruralis*, and running along this whole extremity, detaches many ramifications all the way to the foot, as we shall see more particularly hereafter.

39. The *vena azygos*, or *sine pari*, is very considerable, and arises posteriorly from the superior cava a little above the pericardium.

*Vena azygos, and  
vena intercostales.*

40. It is immediately afterwards bent backward over the origin of the right lung; forming an arch which surrounds the great pulmonary vessels on that side, as the arch of the aorta does those of the left side, with this difference only, that the curvature of the *azygos* is almost directly backward, whereas that of the aorta is oblique.

41. From thence it runs down on the right side of the *vertebræ dorsi* on one side of the aorta, and before the intercostal arteries; and getting behind the diaphragm, it terminates by a very sensible anastomosis, sometimes with the *vena renalis*, sometimes with a neighbouring lumbar vein, sometimes immediately with the trunk of the cava inferior, and sometimes otherwise.

42. I have seen this vein extremely large, resembling the trunk of the inferior cava, from the diaphragm, to the origin of the *renales*; the true cava being through all this space very narrow, or of the size of an ordinary *azygos*.

43. The *vena azygos* sends out first of all, two or three small veins from the top of the arch, one of which goes to the *aspera arteria*; the others partly to the *aspera arteria*, and partly



partly to the bronchia, by the name of *venæ bronchiales*, accompanying the ramifications of the bronchial artery.

44. Afterwards the azygos detaches from the extremity of the arch a small trunk common to two or three small veins, called *intercostales superiores dextræ*, which bring back the blood from the first three series of intercostal muscles, and from the neighbouring part of the pleura.

45. These intercostal veins send branches through the intercostal muscles to the serratus superior posticus, serratus major, &c. and afterwards they run along the interstices between the ribs, communicating with the *venæ mammariæ*.

46. They likewise send small branches backward to the vertebral muscles, and canal of the spine, where they communicate with the venal circles, or sinuses, which bring back the blood from the medulla spinalis.

47. As the azygos runs down, it sends off the inferior intercostal veins on the right side, one going to each series of intercostal muscles. These veins run along the lower edges of the ribs, and perforate the muscles by branches, which go to the posterior and external part of the thorax.

48. They communicate with the *venæ thoracicæ*, and most commonly with the *mammaria interna*; and lastly, more or less with each other, by perpendicular branches, near the posterior extremities of the ribs.

49. The azygos sends off likewise the left intercostal veins, but seldom the whole number; for the superior veins come often from the left subclavian, as we shall see in the history of that vein. The inferior intercostal veins, to the number of six or seven, sometimes more, sometimes fewer, come often from the trunk of the azygos, and running between the aorta and vertebræ, to the substance of which they give small capillary twigs, they send off almost the same ramifications with the veins on the right side, and likewise some to the œsophagus.

50. Sometimes these intercostal veins come from a small common trunk which goes out from that of the azygos, and passing between the aorta and vertebræ is bent downward along the left side of the vertebræ, in which course it detaches the intercostals laterally. This small trunk is in some subjects bifurcated upward and downward, as it sends off the intercostals;



intercostals; and in others there are two small common trunks.

51. Lastly, there is sometimes an entire azygos on the left side, which proceeding from the arch of the ordinary azygos, is afterwards distributed in the same manner as the other on the right side; but this disposition likewise varies very much.

52. The azygos having reached below the last rib, sends off a large branch, which bending outward, perforates the muscles of the abdomen, is ramified between their different planes, and communicates with the like ramifications of the last, or last two intercostal veins.

53. Sometimes it sends off the vena diaphragmatica inferior, and likewise gives downward to the first, or first two transverse apophyses of the vertebræ lumbares, a branch which forms the first venæ lumbares dextræ.

54. These communications between the last intercostal, and first lumbar veins are very irregular, being sometimes by a series of opposite angles, sometimes by areolæ, sometimes by a reticular texture, &c. Sometimes the extremity of the vena azygos communicates either mediately or immediately with the vena adiposa, and even with the vena spermatica.

55. The pectorales internæ, are small veins disposed in pairs toward the right and left hand, behind the sternum and parts near it, including the diaphrag-  
*Venæ pectorales internæ.*  
 maticæ superiores, or pericardio-diaphragmaticæ, mediastinæ, mammariæ internæ, thymicæ, pericardiæ, and gutturales or tracheales.

56. All these small veins are divided into right and left; and these are both distributed much in the same manner; but they differ in their origins, because of the inequality in the bifurcation of the cava superior.

57. The right vena mediastina goes out anteriorly from the trunk of the superior cava, a little above the origin of the azygos; the left comes from the subclavia.

58. The right superior diaphragmatica or pericardio-diaphragmatica comes anteriorly from the root of the bifurcation near the mediastina; and is distributed by several branches to the upper, fore, and back parts of the pericardium, communicating with those of the left diaphragmatica, and accompanying the nerve of the same name. The left superior

diaphragmatica comes from the left subclavian a little below the origin of the mammaria.

59. The right internal mammaria arises anteriorly from the vena cava, a little below the angle of the bifurcation. It runs along the nearest internal or posterior edge of the sternum, and on the cartilaginous extremities of the right ribs, together with the artery of the same name. Having reached near the diaphragm, it sends it a branch which runs toward the tendinous plane, and communicates with the common diaphragmatic veins.

60. Afterwards this mammary vein gives small branches to the mediastinum, and others between the ribs to the integuments; of which those that pass between and under the cartilages of the last true ribs, run down on the inner or posterior sides of the muscoli recti abdominis, being ramified among their fleshy fibres, and communicating really with the epigastric veins by several small twigs.

61. The left internal mammaria arises anteriorly from the left subclavian, opposite to the cartilage or anterior extremity of the first true rib.

62. The right vena thymica, when it arises separately, goes out from the bifurcation; and when it is wanting, the thymus, from whence it takes its name, is furnished by the gutturalis or some other neighbouring vein. This vein often reaches no lower than the inferior part of the thymus; and the left vein of the same name comes from the left subclavian, almost opposite to the sternum.

63. The right pericardia seems to go out rather from the origin of the right subclavian, than from the trunk of the superior cava; but in this there are many varieties. It goes to the upper side of the pericardium, and other neighbouring parts. The left pericardia comes sometimes from the left subclavian, before the mammaria, and sometimes from the mammaria or diaphragmatica superior on the same side.

64. The right gutturalis or trachealis goes out from the upper part of the bifurcation, above the mammaria of the same side, sometimes more backward, and sometimes from the subclavia. It is distributed to the glandulæ thyroidææ, trachea arteria, muscoli sterno hyoidæi, thymus, and glandulæ bronchiales. It communicates by lateral branches, more or less contorted, with the internal jugular vein, and sometimes

sometimes by another branch, with a small vein, which the internal jugular sends to the glandula thyroïdes. The left gutteralis comes from the upper or posterior part of the left subclavian near its origin.

65. The smallest internal pectoral veins do not always arise separately, but have sometimes a small common trunk, especially on the right side; and of all these small veins, the *mammaria interna* is the most considerable.

66. The right subclavian vein, as has been already said, is very short, and its course very oblique so that it appears to rise higher than the left vein. It sends off *Vena subclavia.* first of all, four large branches already mentioned, viz. the *vertebralis*, which is the first and most posterior; the *jugularis interna*, *jugularis externa*, and *axillaris*.

67. The left subclavian seems to ascend but very little after the bifurcation, because it runs further and more transversely than the right; and in this course it covers the origin of three large arteries, which come from the curvature of the aorta. It sends off four large branches besides the small pectoral veins, and receives the *ductus thoracicus*.

68. It likewise gives off, before its principal division, a small trunk for the left superior intercostals, which are sometimes six in number, and communicate with the inferior intercostals, and with a branch of the *vena azygos*. This small common intercostal trunk furnishes likewise the left *bronchialis*.

69. Each subclavian vein near the middle of the clavícula, sends off a branch called *cephalica*, which descends near the surface of the body, between the *deltoïdes* and *pectoralis major*, and reaches the arm in the manner which shall be related hereafter.

70. Each external jugular vein arises from the subclavian on the same side, sometimes from the *axillaris*, and sometimes from the union of these two veins. *Vena jugularis externa.* The right and left do not always arise in the same manner; for sometimes the right comes from the subclavian, and the left from the internal jugular on the same side. They run up between the *musculus cutaneus* and *sterno-mastoidæus*, being covered by the former, and crossing over the latter.

71. Sometimes they are double from their very origins; and



and when they are single, each of them divides afterwards into two, one anterior, and the other posterior or rather superior. The anterior vein goes to the throat and face, running up toward the angle of the lower jaw, and the posterior goes to the temples and occiput.

72. The anterior external jugular vein is often a branch of the jugularis interna, and sometimes arises from the communications of the two jugulares in such a manner as that it cannot be said to belong more to the one than to the other. Sometimes, but very rarely, it comes from the vena axillaris.

*Vena jugularis externa anterior.*

73. It runs up toward the lateral part of the lower jaw, between the angle and the chin, like a vena maxillaris, and sends several branches forwards, backwards, and inwards.

74. Posteriorly, it gives, (1.) A large branch on the side of the upper part of the larynx, which communicates with the jugularis interna; and likewise with a large short branch of the jugularis externa posterior, of which below. (2.) A small branch which has the same communication, but which is not always to be found. (3.) Another small branch a little below the lower jaw, which communicates with the jugularis externa posterior.

75. Anteriorly it sends several branches to the muscles of the larynx, sterno-hyoidæi, thyro-hyoidæi, and to the integuments; and below the larynx it sends communicating branches to the jugularis externa anterior of the other side.

76. A little higher, opposite to the cartilago thyroides, it gives off a transverse branch, which runs on the anterior or lower part of the muscoli sterno-mastoidæi, and communicates with the jugularis of the other side, though not always by a vein of the same kind.

77. The superior and inferior transverse branches communicate on each side by branches more or less perpendicular, and send a small branch to the musculus quadratus of the chin, to the musculus cutaneus, and integuments.

78. It sends another large branch anteriorly toward the symphysis of the lower jaw, which, after having supplied the maxillary glands, is distributed to the digastric muscle, to the chin and under lip.

79. Interiorly at the same place it sends out a large branch, which furnishes the glandulæ sublinguales, runs down toward the



the cornua of the Os Hyoides, to communicate with some branches of the jugularis interna, and sends several rami to the tongue, called *venæ raninæ*. It gives off likewise a small branch, which running upon the musculus labiorum triangularis, to the commissure of the lips, is distributed to the neighbouring parts.

80. The same branch which gives out the *venæ raninæ*, detaches another to the lateral parts of the septum palati, which is distributed to the amygdalæ, and to the uvula, and sends rami forward to the membrane which lines the arch of the palate. Another branch goes out from it to the pterygoidæus internus, peristaphylini, and cephalo-pharyngæi.

81. Afterwards the trunk of the anterior external jugular vein runs up on the musculus triangularis, where it receives the name of *vena triangularis* in a winding course from the angle of the lower jaw to the great or internal angle of the orbit, sending branches on each side to the muscles and integuments.

82. These branches communicate with each other, especially one which passes under the zygoma, behind the Os Malæ, to the inferior orbitary or spheno-maxillary fissure, and another small branch, which runs along the inferior portion of the orbitary muscle, to the small or external angle of the eye, where it communicates with the rami temporales and frontales.

83. It is here to be observed, that, under the angle of the lower jaw, there is a great variety of communications between the external and internal jugular veins, and also a great variety in the distribution of these veins.

84. Almost all the ramifications, which at this place go from the external jugular vein, to be distributed on the upper part of the throat and on the face in some subjects, arise in other subjects from the internal jugular; and sometimes, one part of them comes from the external jugular, the rest from the internal.

85. The trunk of the *vena angularis* having reached the bones of the nose, sends out a branch through the lateral cartilages of the nose, which is distributed to the nares; and another which runs down in a winding course to the upper lip.

86. At the great or inner angle of the eye, the same trunk sends

sends off several other branches; the first of which goes to the root of the nose, and communicating with its fellow from the other side, gives several small veins to the holes of the *Ossa Nasi*.

87. The second branch runs up on the forehead, by the name of *vena frontalis*, anciently *præparata*; and is distributed to each side, communicating with its fellow, when any such vein is found.

88. The third branch enters the orbit in a winding course, on one side of the cartilaginous pulley, and communicates with the sinuses of the dura mater, by the orbitary sinus of the eye.

89. The fourth branch goes along the musculus superciliaris and the upper part of the orbicularis, to the small or external angle of the eye, to communicate with the *vena temporalis*, and with that vein which runs along the lower part of the orbicular muscle, with which it forms a kind of circle.

*Vena jugularis  
externa posterior,  
sive superior.*

90. The posterior or superior external jugular vein runs up toward the parotid gland, and lower anterior part of the eye, giving out several considerable branches toward each

side.

91. At its origin it sends out posteriorly, a principal branch with its ramifications, to the muscles which cover the scapula, and joint of the humerus, commonly called *vena muscularis*, and which might be named *super humeralis*.

92. A little higher, it gives off the *vena cervicalis* which goes to the vertebral muscles of the neck. This vein communicates with the humeralis by several areolæ, or venal meshes, and they are both ramified in different manners.

93. These ramifications and communications are in part covered by the musculus trapezius, and communicate likewise with some branches of the *vena occipitalis*, and with a branch of the superior intercostal vein, which perforates the first intercostal muscle.

94. Near the cervical vein, but a little more outward, it gives off sometimes the small *vena cephalica*, which runs down between the pectoralis major and deltoides, as was said N<sup>o</sup> 69, and unites with the *vena cephalica* of the arm, which shall be described hereafter.

95. Backward it detaches the *vena occipitalis*, which is distributed

distributed on the occiput, and sometimes comes from the *vena vertebralis* or *axillaris*, &c. It likewise sends out a small vein, which enters the cranium by the posterior mastoide hole, and terminates in one of the lateral sinuses of the *dura mater*. This branch comes sometimes from another vein.

96. Having reached as far as the parotid gland, it forms communications with the anterior external jugular, under the angle of the lower jaw; and then passes through the parotid gland, between that angle and the condyle, giving off a large branch which communicates with another branch common to the internal and anterior external jugulars.

97. Sometimes there are several branches, which having run a very little way, unite together and represent the short large branch, forming *areolæ* or meshes through which the nerves pass.

98. Afterwards it passes before the ear, taking the name of *vena temporalis*, which is distributed to the temples and lateral parts of the head, towards the occiput and fore-head. Sometimes the temporal vein has two origins, whereof one is from the *jugularis interna*.

99. The temporal vein of one side communicates above, with its fellow on the other side; before, with the *vena frontalis*; and behind, with the *vena occipitalis*. Opposite to the ear, it gives out a large branch, one ramus of which runs under the lower edge of the zygoma, and then returning, communicates with another ramus from the same *jugularis*, a little below the condyle of the lower jaw, forming a kind of island irregularly round.

100. Behind this condyle, it gives branches to the temporal muscle, to the neighbouring parts of the upper jaw, and to the inside of the lower jaw, almost in the same manner as is done by the arteries.

101. Only one of these branches runs from without inward, between the condyloide and coronoide apophyses, to be distributed to the *musculus temporalis* and *pterygoidæi*; sending off a ramus to the *masseter*, in its passage.

102. The internal jugular vein, is the largest of all those that go to the head; though not so large as it seems to be, when rejected.

*Vena jugularis interna.*

103. It runs up behind the *sterno-mastoidæus* and *omohyoidæus*.



hyoidæus which it crosses; along the sides of the vertebræ of the neck, by the edge of the longus colli, to the fossula in the foramen lacerum of the basis cranii.

104. The first branches which it sends off are small, and go to the thyroide glands. About two fingers breadth higher up, it detaches a middle-sized branch which runs laterally towards the larynx, and may be named *vena gutturalis*.

105. This guttural vein divides chiefly into three branches; the lowest of which goes to the thyroide gland and neighbouring muscles; the middle branch to the larynx, musculi thyroidei, &c. and the third runs upward to the great communication between the two jugulares already mentioned. In this, however, there is some variety, and I have seen the left guttural vein go out from the axillaris.

106. About the same distance upward, almost opposite to the Os Hyoides, the internal jugular gives another branch, which sends rami to the muscles belonging to that bone, and others which communicate with the foregoing branch. This other branch runs upward toward the parotid gland and angle of the lower jaw, where it sends communicating branches forward and backward to the two external jugulares.

107. It is at this place likewise, that the internal jugular sometimes produces the vena maxillaris interna and all its ramifications, as has been already said in the description of the jugularis anterior externa.

108. The internal jugular sends another branch backward, which is distributed to the occiput, where it communicates with a branch of the vertebralis; and through the posterior mastoide hole, with the lateral sinus of the dura mater. This communication is sometimes by an anastomosis with a branch of the external jugular, or of the cervicalis, which goes thither.

109. Afterwards it reaches the foramen lacerum of the basis cranii, bending a little, and sending off small twigs to the pharynx and neighbouring muscles.

*Vena vertebralis.* 110. The vertebral vein arises posteriorly from the subclavia or axillaris, sometimes by two stems, sometimes by one, which soon afterwards divides into two.

111. The first and principal stem gives out a branch called *vena cervicalis*, which is distributed to the neighbouring muscles,



muscles, and afterwards runs up through the holes of the transverse apophyses of the vertebræ colli. This cervical branch comes sometimes from the axillaris.

112. The other stem of the vertebral vein runs up on the side of the vertebræ, and having reached the fourth, or sometimes higher, it runs in between the transverse apophyses of that vertebra and of the fifth, to join the first or principal stem.

113. Thus the vertebral vein accompanies the artery of the same name, sometimes in one trunk, sometimes in several stems, through all the holes of the transverse apophyses of the vertebræ colli, all the way to the great foramen occipitale, communicating with the occipital veins and small occipital sinuses of the dura mater.

114. In its passage it gives off one branch which enters by the posterior condyloide hole of the Os Occipitis, and communicates with the lateral sinus of the dura mater; but it is not always to be met with.

115. As these veins run through the holes in the transverse apophyses, they send branches forward to the anterior muscles of the neck, and to the small interior muscles of the head.

116. Other branches go likewise outward and backward to the musculi transversales and vertebrales colli; and inward to the great canal of the spinal marrow, where they form sinuses, which communicate with those on the other side.

117. These vertebral sinusses are pretty numerous, and placed one above another all the way to the occiput; the lower communicate with the upper; and at the great foramen of the Os Occipitis there is a communication between them and the occipital sinuses of the dura mater.

118. The subclavian vein having sent off the branches already described, goes out of the thorax, and passes before the anterior portion of the musculus scalenus, and between the first rib and the clavicle, to the axilla. Through this course it takes the name of *vena axillaris*, and gives off several branches, the chief of which are the venæ musculares, thoracicæ, and vena cephalica, which is sometimes double.

119. The first veins which it sends off are the musculares,

distributed to the middle portion of the musculus trapezius, to the angularis, infra-spinatus, and subscapularis; and as some of these branches go to the shoulder exteriorly, others interiorly; the venæ scapulares are distinguished into external and internal.

120. A little before the axillaris reaches the axilla, it sends out the venæ thoracicæ, one of which is superior, called also *mammaria externa*, and the other *inferior*. It likewise sends rami to the musculus subscapularis, teres major, teres minor, supra-spinatus, latissimus dorsi, serratus major, pectoralis minor, pectoralis major, and to the glands of the axilla; and sometimes gives a communicating branch to the vena basilica.

121. The axillaris having reached the side of the head of the Os Humeri, produces a very considerable branch named *vena cephalica*, and afterwards runs along the arm by the name of *vena basilica*; which however appears sometimes to be rather a branch, than a continuation of the trunk of the axillaris; in which case the cephalica and basilica might be looked upon as two principal branches of the axillary vein.

122. The cephalic vein which is a branch of the axillaris, at a small distance from its origin, joins the *Vena cephalica*. small cephalica which runs down from the subclavia or jugularis externa; having till then run near the surface of the body between the deltoides and pectoralis major, and sometimes these two veins communicate before their union.

123. The great cephalica runs down between the tendons of the last mentioned muscles, and along the outer edge of the external portion of the biceps; communicating several times with the vena basilica, and sending small rami on each side, to the neighbouring muscles, fat, and skin. Some branches go out from its upper part, which lower down unite again with the trunk.

124. A little below the external condyle of the Os Humeri, it detaches a branch backward, which runs up between the musculus brachialis and the upper portion of the supinator longus, and afterwards bends back between the Os Humeri and anconæus externus, where it communicates with some branches of the basilica.

125. Having reached very near the fold of the arm, it is divided

divided into two principal branches, one long, the other short. The long branch is named *radialis externa*, and the short one may be called *mediana cephalica*, to distinguish it from another mediana, which is a short branch of the basilica; and therefore ought to be called *vena mediana basilica*.

126. The external radial vein runs along the radius between the muscles and integuments, giving off branches toward both sides, which communicate with other branches of the same vein, and with some from the basilica, forming areolæ much in the same manner as the saphena does in the lower extremity.

127. The mediana cephalica runs down obliquely toward the middle of the fold of the arm, under the integuments, and over the tendon of the biceps, where it joins a short branch of the same kind from the basilica, which I have already named *mediana basilica*. These two medianæ unite in an angle, the apex of which is turned downward.

128. From this angular union, or anastomosis, a considerable branch goes out, which runs down on the fore-arm, uniting on one side with the vena cephalica, and communicating on the other with the basilica, by several irregular areolæ. The name of *mediana* is given to this large branch, as well as to the two short ones, by the union of which it is formed; but that they may not be confounded, this large branch may be termed *mediana major*, or *media*, the names already given to the other two being retained.

129. From this union of the two lateral medianæ, and sometimes from the origin of the mediana media, which is the true mediana of Riolan, a branch goes out which runs down on the inside of the fore-arm, opposite to the interosseous ligament, and is called *vena cubiti profunda*. It goes to the neighbouring muscles, and communicates with the other veins of the fore-arm. The mediana cephalica sometimes sends down a long branch, called *radialis interna*, which lies almost parallel to the *radialis externa* already mentioned.

130. Afterwards, the cephalica having reached the extremity of the radius, is distributed by numerous areolæ, almost in the same course with the radial artery.

131. A particular branch goes out from it, which runs more or less superficially between the thumb and metacarpus,



pus. by the name of *cephalica pollicis*. The areolæ furnish the interosseous muscles and integuments, and communicate with a small ramus from the basilica, called by the ancients *salvatella*.

132. The ancients termed the basilic vein of the right arm, the *vein of the liver*, or *vena hepatica brachii*; and that of the left arm, the *vein of the spleen*, or *vena splenica brachii*. It has sometimes a double origin, by a branch of communication with the trunk of the axillaris.

133. It sends off first of all, under the head of the Os Humeri, a pretty large branch, which passes almost transversely round the neck of that bone, from within, backward, and from behind, outward, running up on the scapula. where it is ramified on the deltoides, and communicates with the *venæ scapularis externæ*. This branch may be named *vena sub humeralis*, or *articularis*, as the artery which lies in the same place; they both having much the same course.

134. This articular vein sends down two principal branches, one of which runs along the inside of the bone, to which, and to the periosteum, it gives small veins. The other turns forward, toward the middle of the arm, between the bone and the biceps, and communicates with the *cephalica*.

135. Below the neck of the Os Humeri, near the hollow of the axilla, and behind the tendon of the *pectoralis major*, the basilica sends out a considerable branch, which runs down on the side of the brachial artery, and furnishes the neighbouring muscles on both sides. This vein is named *profunda brachii*, or *profunda superior*.

136. Immediately afterwards, the basilica detaches two or three small veins, which run down very closely joined to the brachial artery, surrounding it at different distances by small twigs which communicate with each other. These veins might be named *venæ satellites arteriæ brachialis*.

137. These small veins which often arise from the *profunda superior*, communicate with the basilica and *cephalica*; and having reached the fold of the arm, they divide like the artery, and the same divisions are continued along the whole fore-arm, through all which space they accompany and surround the arterial branches in the manner already said.

138. Afterwards



138. Afterwards the basilica continues its course along the inside of the Os Humeri, between the muscles and integuments, forming many communications with the vena profunda, satellites, and cephalica, and supplying the muscles and integuments.

139. Having reached the inner condyle, and having sent off obliquely in the fold of the arm, the mediana basilica, it runs along the ulna, between the integuments and muscles, a little toward the outside, by the name of *cubitalis externa*, still communicating with the profunda, satellites, and cephalica.

140. Having detached the mediana basilica, it sends out another branch which runs down along the inside of the forearm, near the ulna, and communicates with the mediana major, &c. This branch may be named *cubitalis interna*.

141. The basilica having at length reached the extremity of the ulna, sends several branches to the convex side of the carpus; one of which named *salvatella*, goes to that side of the little finger next the ring-finger, having first communicated with the cephalica, by means of the venal areolæ conspicuous on the back of the hand. In the other fingers this vein follows nearly the same course with the artery.

142. In general, the external or superficial veins of the forearm are larger than the internal; but they are accompanied only by small arteries, whereas the deep veins accompany large arteries.

143. The inferior vena cava having run down about a quarter of an inch from the right auricle of the heart, within the pericardium, as has been already said, pierces that membrane, and the tendinous portion of the diaphragm which adhere very closely to each other.

*Vena cava inferior.*

144. At this place it gives off the venæ diaphragmaticæ or phrenicæ, which are distributed to the diaphragm, and appear chiefly on its lower side, one towards the right hand, and one towards the left. The right vein is more backward and lower than the left. The left is distributed partly to the pericardium, and partly to the diaphragm; and sometimes they send rami to the capsulæ renales, much in the same manner as the arteriæ phrenicæ.

145. The inferior cava having perforated the diaphragm, passes

passes through the posterior part of the great fissure of the liver, penetrating a little into the substance of that viscus, between the great lobe and the lobulus Spigelii, being however covered but very little on the backside by the substance of the liver, till it reaches the lobulus.

146. In its passage, it sends off commonly three large branches, called *venæ hepaticæ*, which are ramified in the liver. Sometimes there are only two, and sometimes four.

147. Besides these large branches, it sends out some other small ones, either before or immediately after it goes out of the liver; which, according to some anatomists, answer to the branches of the hepatic artery, as the large branches do to those of the *vena portæ*.

148. In the fœtus, as the *vena cava* passes by the liver, it gives off the *ductus venosus*, which communicates with the sinus of the *vena portæ*, and in adults is changed to a flat ligament.

149. After its passage through the liver, the *vena cava* turns from before backward, and from right to left, toward the *spina dorsi*, placing itself on the right side of the *aorta*, which it accompanies from thence downward.

150. Having got as low as the *arteriæ renales*, it gives off the veins of the same name, termed formerly *venæ emulgentes*, and which are the largest of all the veins that go from the *cava inferior*, from the liver to the bifurcation.

151. The right renal vein is the shortest, and runs down a little obliquely because of the situation of the kidney. The left vein, which is the longest, crosses on the fore-side of the trunk of the *aorta*, immediately above the superior mesenteric artery; and both veins accompany the renal arteries.

152. They send up the *venæ capsulares*, which go to the *glandulæ renales*, and downward, the *venæ adiposæ*, which go to the fatty covering of the kidneys; and ordinarily the left renal vein furnishes the left spermatic vein. Afterward they run to the sinus or cavity of the kidneys, in the substance of which they are distributed by numerous ramifications.

153. A little below the renal veins, the trunk of the *cava* sends out anteriorly toward the right side, the right *vena spermatica*. The left spermatic vein comes commonly, though

though not always, from the left renales, as has been already observed. Both veins accompany the spermatic arteries, to the parts to be mentioned hereafter.

154. In their passage, they send several small branches on each side, to the peritonæum and mesentery, where they seem to be joined by anastomoses with the *venæ mesaraicæ*, and consequently with the *vena portæ*.

155. They sometimes send a considerable branch over the iliac muscle, which afterwards dividing into two, one ramus runs up to the *membrana adiposa* of the kidneys, the other runs down on the last-mentioned muscle.

156. About the same height with the spermatic vein, the inferior cava sends off posteriorly in some subjects, a branch which runs upward, and communicates with the *vena azygos*. Sometimes this branch goes out from one or other of the renales, and appears to be a true continuation of the extremity of the *azygos*.

157. The cava sends likewise off posteriorly the *venæ lumbares*, which commonly arise in pairs in the same manner as the arteries of the same name go out from the aorta. These may be divided into superior and inferior veins.

158. Their origins vary in different manners. Sometimes the cava gives off a branch to each side below the first vertebra of the loins, which, like a common trunk, furnishes the lumbar veins. This branch communicates with the *azygos*.

159. Sometimes a considerable branch goes out from the lower extremity of the cava, near the bifurcation, chiefly on the right side; which afterwards running up between the bodies and transverse apophyses of the vertebrae, detaches the *venæ lumbares*, and communicates with the *azygos*.

160. Sometimes a like branch comes from the beginning of the left *vena iliaca*, and running up on that side in the same manner, produces the *lumbares*. This branch likewise communicates with the *azygos*, and with the superior or descending ramus *lumbares*.

161. The *venæ lumbares* on one side, communicate by transverse branches with those of the other side, and likewise with each other by branches more or less longitudinal. The first and second often go from the *azygos*, and thereby they communicate with the intercostal veins.

162. The



162. The lumbar veins send small capillaries, in their passage, to the substance of the bodies of the vertebræ; and they are distributed to the muscles of the abdomen, quadratus lumborum, psoas, iliacus, &c. They send branches backward to the neighbouring vertebral muscles, and to the canal of the spine, and communicate with the venal sinuses in the same manner as the intercostals.

163. The inferior cava having reached as low as the last vertebra of the loins, and near the bifurcation of the aorta, runs in behind the right iliac artery, and there is divided into two subaltern trunks, called the right and left iliac veins.

164. The extremity of the trunk of the vena cava, passes in some subjects behind the origin of the right iliac artery; in others, it is the left iliac vein which passes there, and consequently crosses the right iliac artery. Afterward the left iliac vein accompanies the inside of the left artery, till it goes out of the abdomen. Therefore the iliac veins lie on the insides of the arteries at this place.

165. From this bifurcation of the vena cava, and often from the origin of the left iliaca, the vena sacra goes out, and accompanies the artery of the same name in its distribution to the Os Sacrum, to the nerves which lie there, and to the membranes which cover both sides of that bone.

166. Each original iliac vein is divided on the side of the *Vena iliaca*. Os Sacrum, much after the same manner as the arteries, into two large trunks, or secondary iliac veins. This second bifurcation is about a finger's breadth below that of the iliac arteries.

167. One of these trunks is named *vena iliaca externa*, or *anterior*; the other *interna*, or *posterior*. The external vein is likewise named simply *iliaca*, and the internal, *hypogastrica*. The external vein seems to be the true continuation of the trunk, and the hypogastrica only a branch. I here speak of adult bodies, because in the fœtus there is a considerable variation.

168. These veins follow nearly the course and distribution of the iliac arteries, except that the hypogastric vein does not send off the vena umbilicalis. The external iliac veins lie more or less on the inside of the arteries, in the manner already said; but the hypogastric veins, in the bottom of the pelvis, lie almost behind the arteries on the same side.

169. From



169. From the common trunk of the iliac veins, and sometimes from the origin of the iliaca externa, a particular branch goes out, which is distributed to the musculus psoas, iliacus, and quadratus lumborum; and afterwards sends a ramus on the foreside of the last transverse apophyses of the loins, to communicate with the last lumbar vein.

170. The external iliac, a little before it leaves the abdomen, near the ligamentum Falloppii, lying on the psoas and iliac muscles, gives off almost the same branches with the artery of the same name, and follows the same course. The chief branches are these.

171. A little before it goes out of the abdomen, it sends off from the outside, a small branch, which runs up along the crista of the Os Ilium, and gives branches on each side, to the lateral and posterior lower portions of the muscoli abdominis, to the musculus iliacus, &c.

172. From the inside, before it leaves the abdomen, it sends off the vena epigastrica; which having furnished some small rami to the neighbouring conglobated glands, runs up along the inside of the muscoli recti, on which it is ramified both ways; as also on the broad muscles of the abdomen, by other small branches, which penetrate from within outwards.

173. Afterwards, the vena epigastrica runs upward, and joins the ramifications of the mammaria, by an equal number, accompanying the epigastric artery. From the inside of the epigastric vein, a branch is sometimes detached to the musculus obturator internus, where it joins another ramus named *vena obturatix*.

174. Before the iliac vein gets from under the ligamentum Falloppii, it sends several small rami to the neighbouring lymphatic glands; and immediately afterwards, losing the name of *iliaca*, it takes that of *cruralis*.

175. The hypogastric or internal iliac vein, runs behind the artery of the same name, making the same kind of arch, from which the following branches go out.

*Vena hypogastrica.*

176. From the posterior or convex part of the arch, it gives a branch to the superior lateral part of the Os Sacrum, which is distributed to the musculus lacer or transverso-spinalis lumborum, and other muscles thereabouts, and to the

cavity of the bone, which it enters through the first great hole.

177. A little lower, on the same side, it sends out another which is distributed much in the same manner with the former, and enters the second hole.

178. From the external lateral part of the same arch, a little anteriorly, it sends out a large branch, which runs behind the great sciatic sinus, and is distributed to the musculi glutæi, pyriformis, and gemelli.

179. Lower down, the same lateral part of the hypogastric vein gives out another large branch; which having run a little way, detaches several rami, and afterward reaching the foramen ovale of the Os Innominatum, perforates the obturator muscles, communicates with the vena cruralis, and is distributed to the musculus pectineus, triceps, and neighbouring parts. This vein is termed *obturatrix*, from its passing through the muscles of that name.

180. Among the branches sent off by the vena obturatrix, before it perforates the muscles, one is situated exteriorly, which runs toward the sciatic sinus, to the musculus iliacus, the superior part of the obturator internus, and to the Os Ilium, near its symphysis with the Os Ischium.

181. Interiorly, the same obturator vein sends off another branch, which is distributed to the ureters, bladder, and internal parts of generation in both sexes. It communicates with the spermatic veins, and is more considerable in women than in men.

182. Lastly, the hypogastric vein runs backward, and goes out of the pelvis, above the ligament which lies between the inferior lateral part of the Os Sacrum and spine of the Ischium; and as it goes out, it is ramified chiefly upward and downward.

183. It sends a large branch upward to the lower part of the Os Sacrum, and two or more downward; which running behind the same ligament, are distributed to the buttocks, anus, neighbouring portion of the musculus pectineus, and to the external parts of generation, nearly in the same manner with the artery which accompanies them.

184. The veins that go to the anus, are termed *hæmorrhoidales externæ*, and they that go to the parts of generation, *pudicæ internæ*. The external hæmorrhoidales communicate with the internal veins of the same name, which come from  
the

the small *vena mesariaca*, one of the branches of the *vena portæ*, as we shall see hereafter.

185. The crural vein goes out under the ligamentum Fallopii, on the inside of the crural artery, and immediately gives small branches to the inguinal glands, the *musculus pectineus*, and parts of generation. These last are termed *pudicæ externæ*, and evidently communicate with the internal veins of the same name. *Vena cruralis.*

186. About an inch below where it leaves the abdomen, the crural vein produces a large branch which runs down anteriorly between the integuments and the *sartorius*, following the direction of that muscle almost all the way to the inside of the thigh.

187. This branch having afterwards got beyond the condyles of the *Os Femoris*, runs down between the integuments and inner angle of the tibia, to the fore-part of the inner angle, and is distributed to the foot. All this large branch is named *vena saphena*, or *saphena major*.

188. After the origin of the *saphena* as the trunk of the crural vein runs down; it sinks in between the muscles, and is distributed to all the inner or deep parts of the lower extremity, accompanying the crural artery to the very extremity of the foot, being all along more considerable than the artery, both for capacity and ramifications, a thing very common in the veins.

189. As the *saphena* is a vein of very large extent, I shall here describe it altogether, and afterwards return to the *vena cruralis*.

190. The *vena saphena*, in its passage from the inguen to the foot, is covered only by the skin and fat. Immediately after its rise, it gives small veins to the inferior inguinal glands; and then it gives out others more anteriorly, which running under the integuments, communicate with each other by numerous areolæ, or meshes. Sometimes these communications come all from the rami of one branch. *Vena saphena.*

191. The *saphena*, having run down on the thigh as low as the middle of the *sartorius*, sends off to the same side several branches, which communicate with each other, and with the superior branches already mentioned; and as they run down, they communicate again with the trunk of the *saphena*.



192. These two sorts of communications furnish a third collateral kind, from which likewise particular branches are detached, which communicate with each other at different distances all the way to the knee.

193. Between these upper and lower branches, the saphena sends backward a particular branch; which, after being distributed to the integuments which cover the gracilis internus and triceps, turns backward; and a little below the ham, runs in among the muscles situated there; and communicates with another branch, which may be termed *saphena minor*.

194. Afterwards the trunk of the great saphena runs down on the inside of the tibia, lying always near the skin; and at the upper part of that bone, it sends branches forward, outward, and backward.

195. The anterior branches go to the integuments on the upper part of the leg; the posterior, to those which cover the gastrocnemii, and communicate with the little saphena; and the external branches are likewise distributed to the fat and integuments, and having reached as low as the middle of the tibia, it sends a communicating branch to the trunk of the great saphena.

196. From this communication, a branch goes out anteriorly, which runs along the integuments of the tibia, all the way to the outer angle, having in its passage communicated again with the great saphena.

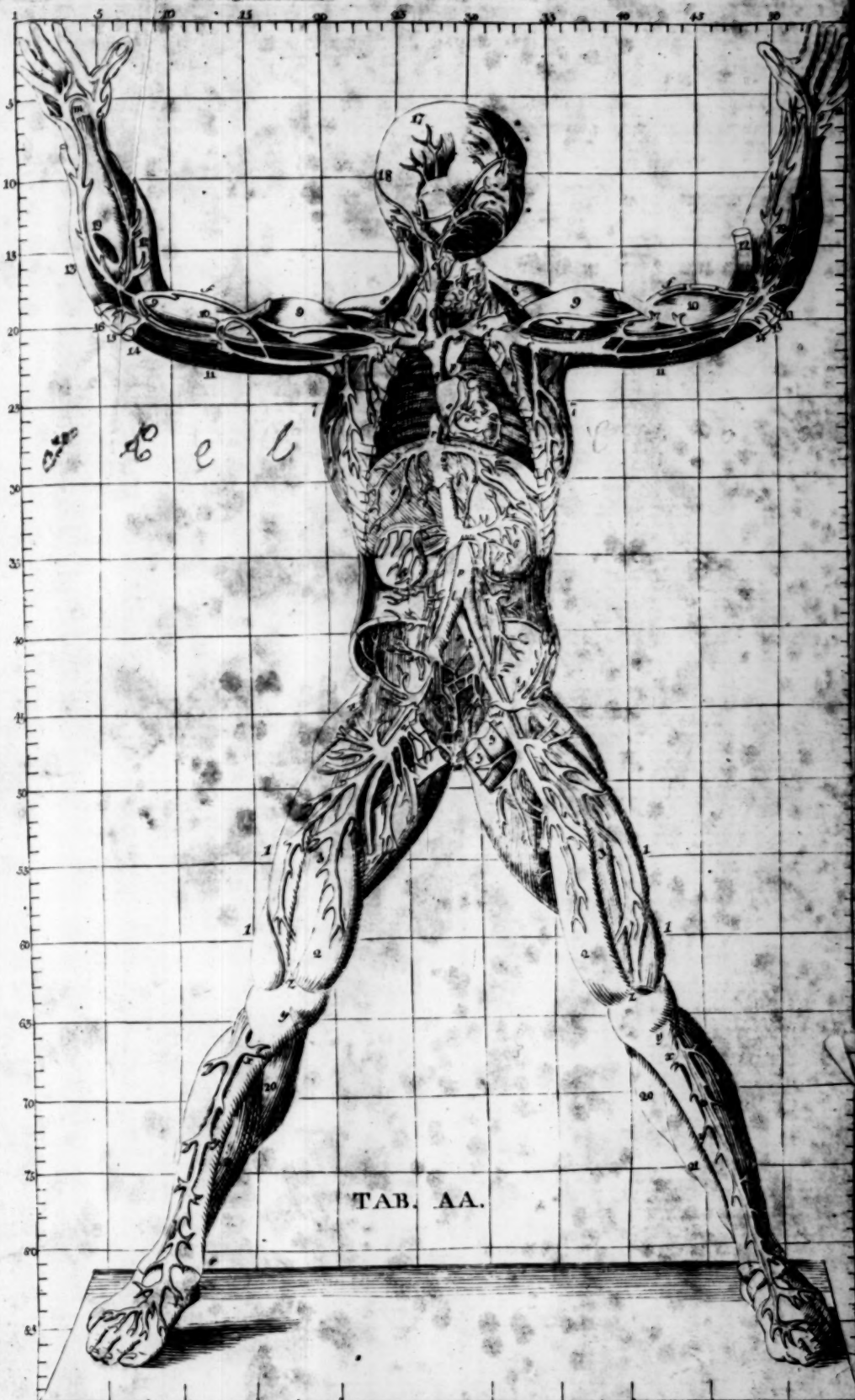
197. As the saphena runs down on the inside of the tibia, it sends out a branch near the middle of that bone, which runs up behind the tendons of the sartorius, gracilis internus, and semi-nervosus, then between the tibia and upper end of the soleus, and is joined by an anastomosis with the crural vein.

198. It likewise detaches to the fore-part of the tibia some branches irregularly transverse; which having been distributed to the periosteum and bone, communicate with other branches already mentioned.

199. At the lower part of the tibia, the saphena produces a considerable branch, which runs obliquely forward over the joint of the tarsus toward the outer angle, sending off several rami which communicate with each other, and with the trunk of the saphena.

200. Lastly,

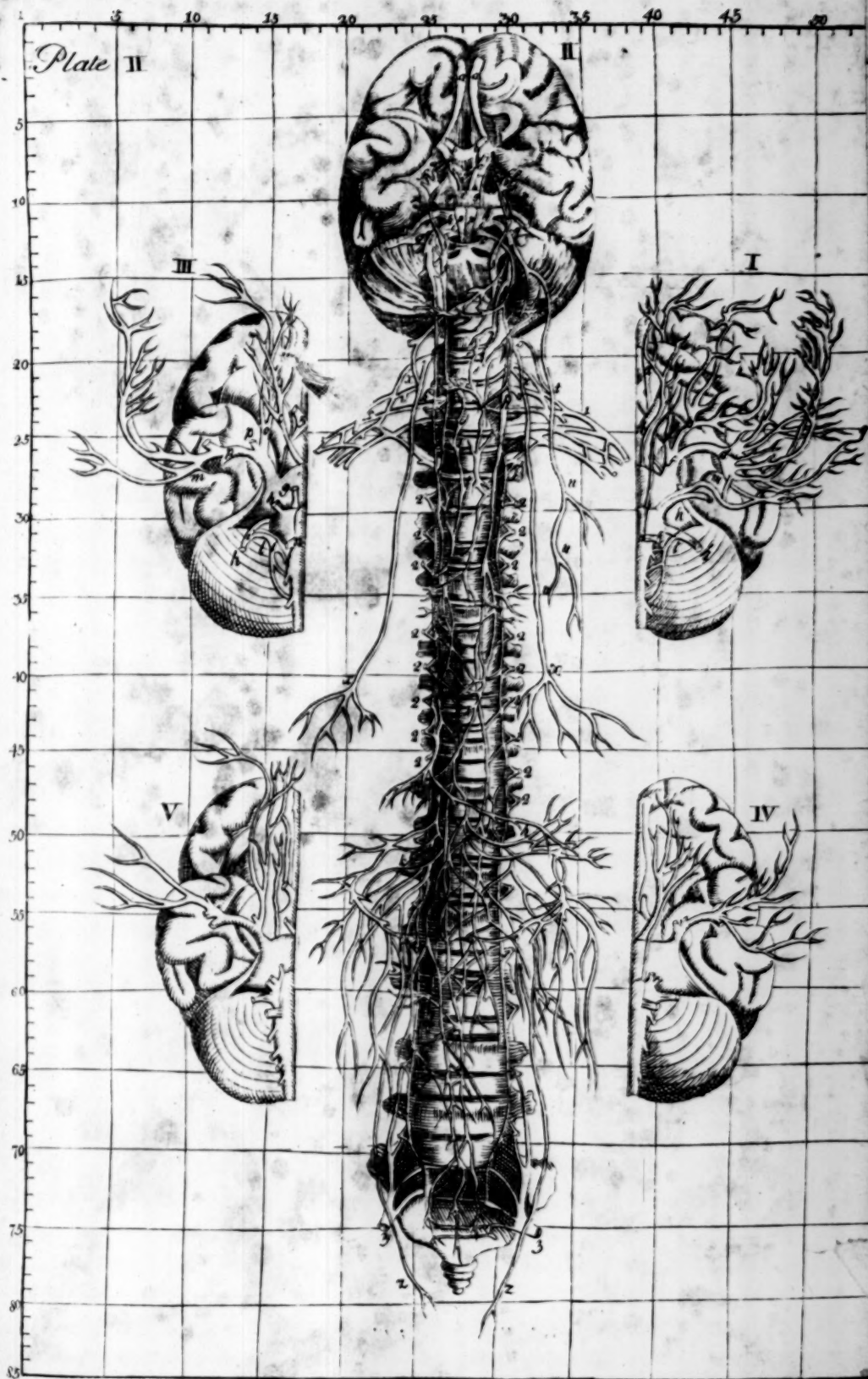




*Pl. 1. to follow the last Page of the Explication —*



Plate II



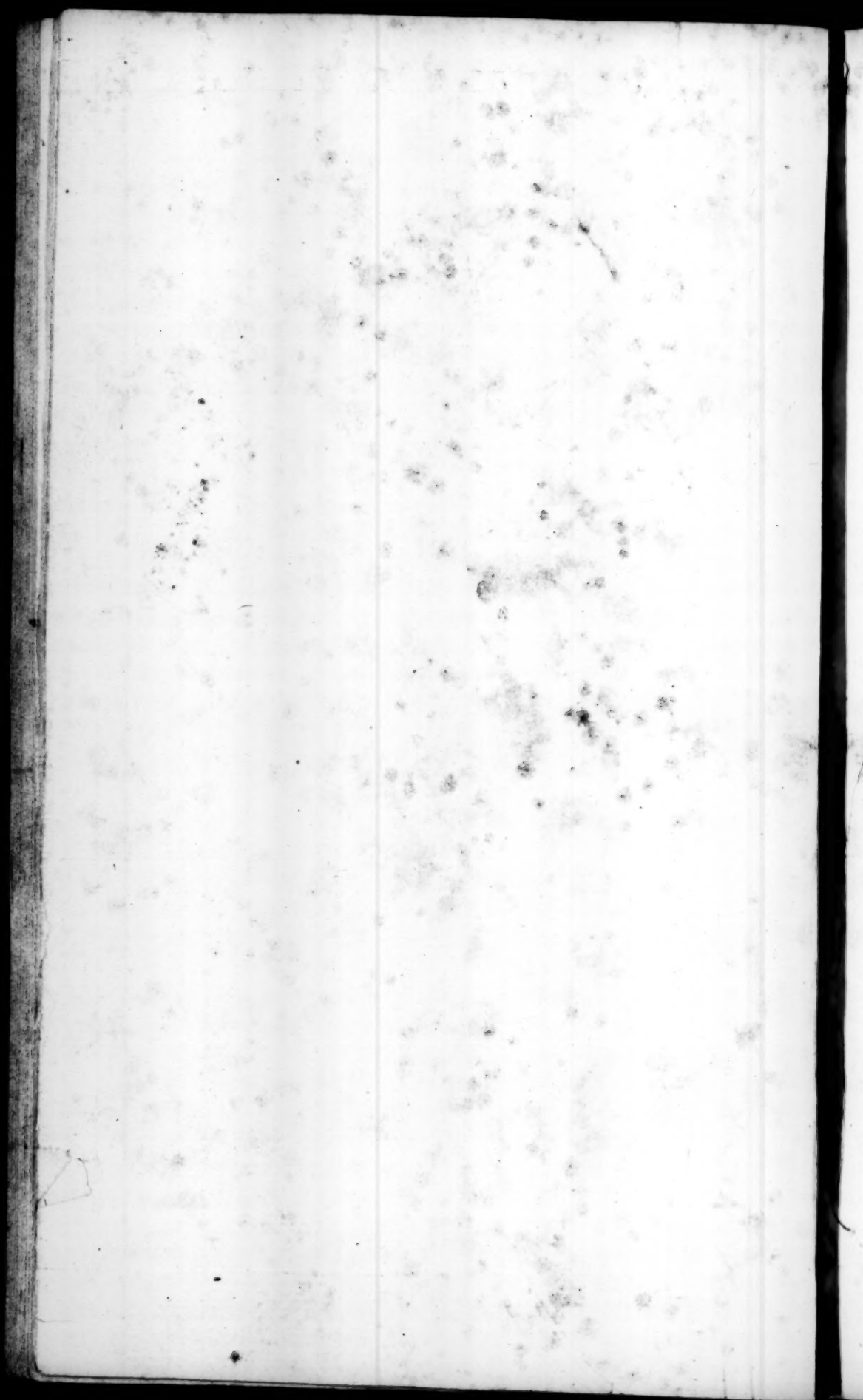




Plate 3<sup>d</sup>

I



III



II



V



IV



VIII



VI



VII



X



XI



IX



XII



XIII

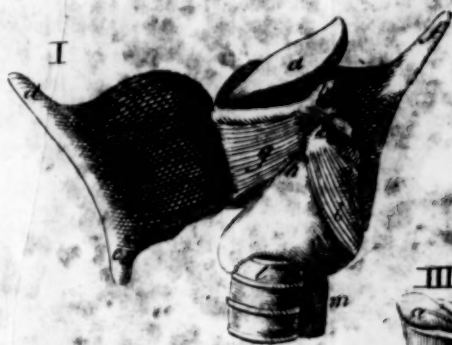


XIV





Plate 4.<sup>a</sup>



IX as  
the  
m-  
in  
es





200. Lastly, the extremity of this trunk passes on the fore-side of the inner angle, and runs irregularly under the skin, along the interstice between the first two metatarsal bones, toward the great toe, where this vein terminates.

201. Having got below the inner angle, it sends a branch outward and forward, which runs under, and in some measure accompanies the anterior tibial artery. Interiorly it sends another branch, almost from the same place, which passes under the foot, communicating with the external tibial vein by irregular arches, from which veins are sent to the toes.

202. Lastly, before the saphena terminates at the great toe, it detaches a kind of transverse arch over the metatarsus, which communicates by several branches with that arch which lies on the joint of the tarsus, and sends others to the toes. This arch gives off likewise another branch, which runs up behind the outer angle, and communicates with the vena tibialis externa.

203. The crural vein having sent off the saphena, and the small branches for the pectineus, &c. as has been said, runs down on the thigh behind the crural artery. Opposite to the little trochanter, it produces two large short branches, or one which afterwards divides into two, whereof one is anterior, the other posterior.

*Continuation  
of the vena  
cruralis.*

204. The anterior branch runs more or less transversely forward, to be distributed to the vastus internus, lower part of the pectineus, and of the second triceps, and to the other two muscles of the same name, running in between them as it goes from one to the other.

205. The posterior branch runs more or less transversely backward, and furnishes the glutæi, vastus externus, and beginning of the biceps.

206. A little below these two branches, about the upper extremity of the vastus internus, the crural vein produces a branch which runs down on the side of the trunk, covering the crural artery, almost as low as the ham, where it is again united to the trunk by an anastomosis, and sometimes it is continued separate a little way down on the leg. It has the name of *vena sciatica* from the sciatic nerve which it accompanies.

207. On the outside of this anastomosis, the crural vein gives

gives off a branch which runs backward between the biceps and neighbouring muscles, and so downward on the backside of the leg a little exteriorly, and very near the skin, all the way to the outer angle. This vein is termed *saphena minor* or *externa*,

208. The little *saphena* having got near the integuments in its course downward, gives out a branch *Saphena minor.* which runs backward, and communicates with the great *saphena* about the middle of the backside of the thigh, as has been already observed.

209. Immediately above and below the ham, this vein sends out other branches, which likewise communicate with the *saphena* major, and having run down about one third part of the backside of the tibia, it sends off another branch which is afterwards reunited to the trunk.

210. About the beginning of the tendo Achillis, the little *saphena* runs outward in the integuments, toward the outer angles, where it terminates in cutaneous ramifications sent to every side.

211. The crural vein having detached the little *saphena*, runs down between the biceps and the other flexors of the leg, closely accompanied by the crural artery, between which and the inner condyle of the Os Femoris, it is situated.

212. A little above the ham, it takes the name of *vena poplitea*. *plitea*; and as it runs down betwixt the two condyles, it gives branches to the flexor muscles above mentioned, to the lower and posterior parts of both vasti, and to the fat which lies above the interstice of the two condyles.

213. It likewise gives off several other branches, one of which runs up laterally between the outer condyle and the biceps, and then turning forward, is ramified in the same manner with the artery. Another branch goes backward, sending ramifications to the beginning of the gastrocnemii, after which it runs down on the backside of these muscles to the tendo Achillis.

214. Near the internal condyle, the *poplitea* sends some lateral branches to the extremities of the neighbouring muscles, especially those of the semi-nervosus, semi-membranosus, &c. Lastly, it sends a branch toward the external condyle,

dyle, which having run for a small space on the peronæus longus, goes back again into the trunk.

215. The vena poplitea runs down immediately behind the muscle of the same name, at the lower part of which it sends off several ramifications to each side, which divide and unite again in different ways and degrees; and afterwards it loses its name, being divided into three considerable branches, called *tibialis anterior*, *tibialis posterior*, and *peronæa*; of which the *tibialis posterior* is most frequently a continuation of the trunk, and the other two like branches.

216. The anterior tibial vein having distributed some small branches from its very beginning to the muscles behind the heads of the two bones of the leg, perforates the interosseous ligament from behind, forward, and runs between the superior portions of the musculus tibialis anticus, and extensor digitorum communis. *Vena tibialis anterior.*

217. As soon as it pierces the interosseous ligament, it distributes small superficial branches to the head of the tibia and fibula, which run to the joint of the knee, and communicate with the lateral branches of the vena poplitea, already mentioned.

218. Afterwards it divides into two or three branches, which run down together on the foreside of the interosseous ligament in company with the anterior tibial artery, which they surround at different distances, by small communicating circles.

219. These branches having reached the lower extremity of the leg, unite in one, which afterwards divides into several, the ramifications of which are distributed to the foot.

220. A particular branch goes out from the reunited portion, which, at the lower part of the leg, perforates the interosseous ligament from before backward, and communicates with the vena tibialis posterior.

221. The posterior tibial vein gives off from its beginning, a branch toward the inside, which is distributed to the gastrocnemii and soleus. This vein is named *juralis*. *Vena tibialis posterior.*

222. Afterward the posterior tibialis runs down between the soleus and tibialis posticus, giving branches to each of them. It is divided in the same manner as the tibialis anterior



rior, into two or three branches, which, as they run, surround the corresponding artery, by small communicating circles formed at different distances.

223. It continues this course in company with the artery as low as the outer angle, furnishing the musculus tibialis posterior, and the long flexors of the toes. At the lower part of the leg, it communicates with a transverse branch of the saphena, and with the anterior tibial vein, in the manner already said.

224. Lastly, it passes on the inside of the Os Calcis, under the sole of the foot, where it forms the venæ plantares, by dividing into several transverse arches, which communicate with each other, and with the saphena, and send ramifications to the toes, nearly in the same manner as the arteria plantaris.

225. The vena peronæa is likewise double, and sometimes triple. It runs down on the inside of the fibula, almost in the same direction with the arteria peronæa, which it likewise surrounds at different distances, by communicating branches; after the manner of the tibialis posterior.

226. It runs down as low as the outer angle, communicating several times with the tibialis posterior, and sending ramifications to the neighbouring portions of the muscoli peronæi, and long flexors of the toes.

227. The last of these communications makes the venæ plantares in some subjects, to appear rather to come from this vein, than from the tibialis posterior, from which they commonly arise, as we have already observed.

228. The vena portæ is a large vein, the trunk of which is situated chiefly between the eminences on the lower or concave side of the liver, called *portæ* by anatomists; and from thence this vein has got the general name of *vena portæ*, or *vena portarum*.

229. It may be considered as made up of two large veins, joined almost endwise by their trunks, from each of which the branches and ramifications go out in contrary or opposite directions. One of these trunks adheres to the liver, and is ramified in that viscus, its branches accompanying the whole distribution of the hepatic artery.

230. The other trunk is without the liver, and sends its branches



branches to the viscera supplied by the rest of the arteria cæliaca, and by the two mesentericæ, that is, to the stomach, intestines, pancreas, spleen, mesentery, and omentum.

231. The first proportion of this vein may be termed *vena portæ hepatica*, superior or minor, the trunk of which is commonly known by the name of *sinus venæ portarum*. The other portion may be called *vena portæ ventralis*, inferior or major; and this is what I am now to describe, referring the distribution of the other to the history of the liver.

232. The large trunk of the *vena portæ inferior* or *ventralis*, is situated under the lower or concave side of the liver, and joined by an anastomosis to the sinus of the *vena portæ hepatica*, between the middle and right extremity of that sinus, and consequently at a good distance from the left extremity. From thence it runs down a little obliquely from right to left, behind or under the trunk of the *arteria hepatica*, bending behind the beginning of the duodenum, and under the head of the pancreas; its length being about five fingers breadth.

233. Having reached to the head of the pancreas, this trunk loses the general name of *vena portæ*, and terminates in three large principal branches, which are distributed by numerous ramifications, to the viscera already named. The first branch is termed *vena mesaraica*, or *mesaraica major*; the second, *splenica*; and the third, *hæmorrhoidalis interna*, or *mesaraica minor*.

234. The *vena mesaraica major* appears to be a continuation of the trunk of the *vena portæ inferior*. The *splenica* is a capital branch of that trunk; and the *hæmorrhoidalis interna* has sometimes a common origin with the *splenica*, and sometimes is no more than a branch of that vein. In some subjects the *mesaraica major* and *splenica* appear to rise by an equal bifurcation of the trunk of the inferior *vena portæ*, and in others, the *hæmorrhoidalis* arises from the very angle of that bifurcation.

235. The inferior *vena portæ*, before the formation of these three branches, sends off from the trunk several small rami, which are commonly the *venæ cysticæ*, *hepatica minor*, *pylorica*, *duodenalis*, and sometimes the *gastrica recta*, and *coronaria ventriculi*.

236. All these small veins sometimes arise separately; and

in other subjects, some of them go out by small common trunks. It sometimes happens that several of them do not come immediately from the trunk of the vena portæ, but from one of its great branches. -

237. The cystic veins run along the vesicula fellis from its neck to the bottom; and as they are often no more than two in number, they are called *cysticæ gemellæ*, a name given likewise to the arteries which accompany them. They go out from the right side of the great trunk near its beginning, sometimes separately, sometimes by a small and very short common trunk.

238. The small hepatic vein is commonly a branch of one of the cysticæ, or of their common trunk.

239. The vena pylorica arises from the great trunk, almost opposite to the origin of the cysticæ; and sometimes is only a branch of the right gastrica. It passes over the pylorus to the short arch of the stomach, where it is joined by anastomosis with the coronaria ventriculi.

240. The duodenal vein, commonly called *vena intestinalis*, goes out from the great trunk near the cysticæ, and sometimes from the small common trunk of these veins. It is distributed chiefly to the intestinum duodenum, and sends likewise some rami to the pancreas. There is another vein called also *duodenalis*, which is a branch of the gastrica of the same side.

241. The vena gastrica, or gastro-epiploica dextra, and the coronaria ventriculi, come more seldom from the trunk of the vena portæ, than from its great branches, with which I therefore chuse to describe them.

242. The inferior vena portæ, having given off the splenica, changes its name to that of *mesaraica*, or *mesaraica major*, which often appears to be rather a continuation of the trunk, than one of the great branches, as has been already observed.

243. It bends toward the superior mesenteric artery, sending off two veins, and afterwards running up over that artery, it accompanies it in those portions of the mesentery and mesocolon which belong to the small intestines, the cæcum, and right portion of the colon. As it runs down, it forms an oblique arch almost like that of the artery, which is

is likewise ramified on both the convex and concave sides, but not so regularly.

244. The first particular branch from this trunk is called by Riolan *vena colica*. It goes out from the anterior part of the trunk, before it joins the artery, and runs directly to the middle of the colon, where it divides to the right and left, and forms arches. On the left hand it communicates with the superior or ascending branch of the hæmorrhoidalis; and on the right, with the second branch of the mesaraica.

245. This second branch is a little under the first, or colica anterior, and something more toward the right hand. It may be named *gastro-colica*, and is soon divided into two branches, one superior, the other inferior.

246. The superior branch of the vena gastro-colica, sends small veins to the head of the pancreas, and forms the vena gastrica, or gastro-epiploica dextra, which goes from the pylorus to the great curvature of the stomach, and communicates with the gastrica sinistra. In its passage, it supplies the stomach and omentum, and communicates with the pylorica, coronaria ventriculi, &c. as has been already said; and sometimes it forms the pylorica.

247. The inferior branch of the vena gastro-colica, which may be called *colica dextra*, goes to the right portion of the colon; and from thence to the upper part of that intestine, where it is divided archwise, and communicates with the right branch of the colica anterior, and with a branch of the vena cæcalis, as we shall see hereafter.

248. The trunk of the great mesaraic vein sends out sometimes opposite to the gastrica, a particular branch to the omentum, called *epiploica dextra*. But almost immediately before it ascends over the mesenteric artery, it produces two large branches very near each other, which pass behind and under the artery, being distributed to the jejunum and part of the ilium by numerous ramifications, which form arches and areolæ like those of the artery.

249. Afterwards the trunk of the mesaraica passes over the superior mesenteric artery, to which it adheres very closely, and from the convex side of its arch sends out several branches almost in the same manner with the artery; but with this difference, that oftentimes the branches do not arise im-



diately from the vein in so great numbers; and each of them sends out many more ramifications.

250. From the concave side of the meseraic vein, a little below the origin of the second branch from the convex side, arises a branch called by Riolan *vena cæcalis*, which runs to the beginning of the colon, crossing one of the branches of the superior mesenteric artery.

251. This cæcal vein divides by two arches, the uppermost of which communicates with the lower branch of the vena gastro-colica; the other, after having sent ramifications to the intestinum cæcum, and appendicula vermiformis, communicates below, with the extremity of the great meseraic vein.

252. The splenic vein is one of the three great branches of the vena portæ, and may be said in some measure to be a subordinate trunk of that vein. It runs transversely from the right to the left, first under the duodenum, and then along the lower side of the pancreas, near the posterior edge.

253. In this course it gives off several veins, viz. the vena coronaria ventriculi, pancreaticæ, gastrica, or gastro-epiploica sinistra, and epiploica sinistra. It likewise often gives origin to the hæmorrhoidalis interna, the third capital branch of the vena portæ.

254. It terminates afterwards by a winding course, being divided into several branches that go to the spleen; one of which produces the small veins called by the ancients *vasa brevia*.

255. The coronaria ventriculi, so called because it surrounds more or less the upper orifice of the stomach, runs along the small arch of that viscus toward the pylorus, where it joins and becomes continuous with the vena pylorica. In its passage, it gives several rami to the sides of the stomach, which there form numerous areolæ, and communicate with the veins of the great arch.

256. It arises pretty often from the beginning of the splenica, and sometimes from the left side of the extremity of the great trunk of the vena portæ, behind the hepatic artery; and in that case, it is the most considerable of all the small veins that go out from the great trunk.

257. The venæ pancreaticæ are several small branches sent



sent by the splenica to the pancreas, along its lower side. There are other small pancreatic veins which do not arise from the splenica, as has been said in the description of the grastro-colica, one of the branches of the great mesaraic trunk.

258. The left gastric or gastro-epiploic vein, goes out from the splenica at the left extremity of the pancreas; from whence it runs to the great extremity of the stomach, and along the great arch, till it meets the gastrica dextra, which is continuous with the sinistra.

259. In its passage, it gives several branches to both sides of the stomach, which are distributed by numerous ramifications, form many areolæ, and communicate with the branches of the coronaria ventriculi.

260. At a small distance from its origin, this gastric vein sends out a branch, which is distributed to the omentum; and on this account it has been called *gastro-epiploica*. This branch seems to communicate with the hæmorrhoidalis interna.

261. The vena epiploica sinistra arises at the small extremity of the pancreas, and is ramified on the omentum all the way to the colon, where it communicates with the hæmorrhoidalis interna. When this vein is wanting, the branch of the left gastrica already mentioned, supplies its place. It sometimes comes from the most anterior branch, which the splenica sends to the spleen.

262. Lastly, the vena splenica reaches the fissure of the spleen, which it enters through its whole length by several branches, almost in the same manner as the splenic artery. It is from the most posterior of these branches that the veins are sent off to the great extremity of the stomach, formerly known by the name of *vasa brevia*, which communicate with the coronaria ventriculi and gastrica sinistra.

263. The internal hemorrhoidal vein is one of the three great branches of the vena portæ, coming ordinarily from the beginning of the vena splenica, and sometimes from the extremity or angle of the bifurcation of the great trunk of the vena portæ.

*Vena hæmorrhoidalis interna, sive mesaraica minor.*

264. At a small distance from its beginning, it gives to the duodenum a second vena duodenalis, which is sometimes more

more considerable than the first, or that which comes from the great trunk of the vena portæ.

265. Afterwards it is divided into two branches, one superior or ascending, the other inferior or descending. The first runs to the upper part of the arch of the colon, where, after many ramifications, it communicates with a branch of the great mesaraica, with the ramifications of the gastro-epiploica sinistra, and with those of the neighbouring epiploica.

266. The inferior branch runs down on the left portion of the colon, on the lower incurvations of that intestine, and on the rectum all the way to the anus. In this course, it supplies the mesocolon, and forms arches, which send out numerous small ramifications which surround these intestines. It seems likewise to communicate by some capillary twigs with the left spermatic vein.

267. This vein has been named hæmorrhoidalis from the tumours often found at its extremity next the anus, which are called *hæmorrhoides*. The word *interna* is added to distinguish this vein from the hæmorrhoidalis externa, which comes from the vena hypogastrica, and with which this vein communicates by capillary ramifications. The name of *mesaraica minor* agrees to it very well, because of its situation, with respect to the inferior mesenteric artery, which is also less than the superior.

## S E C T. VI.

### *A Description of the Nerves.*

#### *Introduction.*

1. **A**LL the nerves of the human body come originally from the cerebrum or cerebellum, by means of the medulla oblongata, or medulla spinalis. They go out in bundles regularly disposed in pairs, like so many distinct trunks, which are afterwards divided into branches, rami, ramifications, and filaments.

2. The nerves of the medulla oblongata go out, for the most part, through the basis of the cranium, at holes situated according to their disposition. Those of the medulla spinalis

spinalis pass through the lateral foramina of all the vertebræ, and through the great anterior foramina of the Os Sacrum.

3. We commonly reckon ten pairs of these fasciculi or nervous trunks to the medulla oblongata, nine of which go out separately through particular holes of the basis cranii; and the tenth, which arises from the extremity of that medulla, passes through the great occipital foramen.

4. The trunks from the spinal marrow are twenty-four pairs, and may in general be termed *nervi vertebrales*, or *intervertebrales*. Seven of them are called *cervical nerves*; twelve, *dorsal* or *costal*, being true intercostal nerves; and five, *lumbar*; to which must be added, five or six pairs that pass out through the Os Sacrum.

5. Before I enter upon the particular distribution of all these nerves, and the course of their branches, ramifications, and filaments, I think it proper to give a general idea of them in the following table.

6. The nerves of the medulla oblongata are these: *Nerves of the medulla oblongata.*

First pair; *nervi olfactorii*.

Second pair; *nervi optici*.

Third pair; *nervi motores oculorum*, *oculares communes*, *musculares communes*, *oculo-musculares communes*.

Fourth pair; *nervi trochleares*, *musculares obliqui superiores*, *vulgo pathetici*.

Fifth pair; *nervi innominati trigemini*. The subordinate trunks of this pair are three on each side, *viz.* The *nervus orbitarius*, *maxillaris superior*, and *maxillaris inferior*.

Sixth pair; *nervi motores externi*, *oculares externi*, *musculares externi*, *oculo-musculares externi*.

Seventh pair; *nervi auditorii*, which are two on each side, one called *portio mollis nervi auditorii*; the other, *portio dura*, to which I give the name of *nervus sympatheticus minor*.

Eighth pair; *par vagum minus*, which I call *nervi sympathetici medii*.

Ninth pair; *nervi hypoglossi*, *vulgo gustatorii vel linguales*.

Tenth pair; *nervi suboccipitales*.

7. The

*Nerves of the  
medulla spi-  
nalis.*

7. The nerves of the medulla spinalis are these:

One pair called *nervi accessorii* of the eighth pair from the medulla oblongata.

One pair commonly called *nervi intercostales*, which I name *nervi sympathetici majores*.

Seven pairs of *nervi cervicales*, or *intervertebrales colli*.

Twelve pairs of *nervi dorsales*, *costales*, *intercostales veri*, or *intervertebrales dorfi*.

Five pairs of *nervi lumbares*, or *intervertebrales lumborum*.

Five or six pairs of *nervi sacri*.

Two *nervi diaphragmatici*, each formed by a trunk of the second, third, and fourth pair of cervical nerves.

*Nervi brachiales* of each side, formed by the fifth, sixth, and seventh pairs of cervical nerves, and by the first pair of the dorsales.

From these nerves, six branches arise on each side, viz.

*Nervus musculo-cutaneus*.

*Nervus medianus*.

*Nervus cubitalis*.

*Nervus cutaneus internus*.

*Nervus radialis*.

*Nervus axillaris* five *articularis*.

*Nervi crurales* of each side, formed by the first, second, and third pairs of the *nervi lumbares*; and partly by the fourth and fifth.

Each of these nerves is divided into three portions, which are

*Nervus femoris cruralis*, five *cruralis superior*.

*Nervus tibiæ cruralis*, five *cruralis tibialis*.

*Nervus cruralis pedis*, five *cruralis pedalis*.

*Nervi sciatici*, each formed by the trunks of the last two pairs of the *nervi lumbares*, and by the three or four following pairs of the *nervi sacri*.

The principal division of each of these nerves produces the following:

*Nervus sciatico-cruralis*.

*Nervus sciatico-popliteus*.

*Nervus sciatico-tibialis*.

*Nervus sciatico-peroneus*.

*Nervus*



Nervus plantaris internus.

Nervus plantaris externus.

8. I refer the subdivisions of the nervi innominati, or of the fifth pair, and those of the three nervi sympathetici, to the particular description, in which I shall trace the branches, ramifications, and even the most remarkable filaments, all the way to where they enter the muscles, viscera, organs, &c. and I shall pursue their course still further in the particular history of each of these parts.

9. The first pair of nerves of the medulla oblongata, or nervi olfactorii, formerly named *processus mammillares*, arise by medullary fibres, anteriorly and exteriorly, from the eminences of the cerebrum, called *corpora striata*, between the anterior and middle lobes.

*Nervi olfactorii.*

10. They run forward, toward the Os Ethmoides on each side the crista galli, in form of medullary ropes, having a very slender consistence; and in this course they receive some medullary fibres from the anterior lobes of the cerebrum.

11. They are at first very thin, but as they advance, they grow gradually larger and softer; and having reached the sides of the crista without any communication betwixt them, they send off a great number of filaments, which run through the holes of the lamina cribrosa.

12. In their passage through these foramina, they are accompanied and invested by the same number of small productions from the two laminæ of the dura mater, as by particular vaginæ; and they are afterwards distributed by an infinity of small filaments to the membrane which lines all the internal parts of the nose.

13. Each olfactory nerve communicates by particular filaments with some branches of the nervi ophthalmici and maxillaris superior.

14. The optic nerves arise from the eminences of the cerebrum called *thalami nervorum opticorum*; and being first of all incurvated upward, they afterwards approach each other, as they run over the sella sphenoidalis of the basis cranii, at which place they unite a little, and afterwards separate again in their passage to the foramina optica, to the orbits and globe of the eyes.

*Nervi optici.*

15. This union of the optic nerves is on the anterior part

of the glandula pituitaria, and is of a very singular kind, as we shall see in the particular description of the head.

16. The third pair of nerves, commonly called *motores oculorum*, arise immediately before the border of the anterior edge of the great transverse protuberance, ordinarily termed the *processus annularis* of the medulla oblongata.

*Nervi motores oculorum communes.*

17. Each nerve perforates the dura mater, behind the lateral parts of the posterior apophysis of the sella sphenoidalis; and afterwards runs along the upper part of the sinus cavernosus of the dura mater, on one side the curvature of the carotid artery, to the superior orbital, or sphenoidal fissure.

18. From thence it passes into the orbit, and divides into four branches, one superior, one internal, and two inferior, one of which is long, the other short.

19. The superior branch goes off as soon as the trunk enters the sphenoidal fissure, and runs directly to the lower side of the musculus rectus superior of the globe of the eye.

20. Having reached the middle of that muscle or thereabouts, it sends up a ramus to the levator palpebrae superioris; and when this ramus goes off nearer the sphenoidal fissure, it may be looked upon as the second principal branch of the motor oculi.

21. The other three branches go off at some distance from the superior branch. The internal branch is distributed to the musculus rectus internus of the eye; the short inferior branch, to the rectus inferior; and the long inferior branch, to the obliquus inferior, into the substance of which it penetrates, after having run along the rectus inferior.

22. Besides these four or five branches, there is a small short branch which arises most commonly from that which goes to the musculus obliquus inferior; and it forms a small lenticular ganglion, that detaches several very fine filaments round the optic nerve.

23. The filaments of the ganglion perforate the tunica sclerotica of the eye, and then run between this coat and the choroides, all the way to the iris, where they are distributed by very fine ramifications.

24. The small lenticular ganglion produces likewise other nervous filaments, which communicate with the ramus internus or nasalis of the orbital nerve.

25. The

25. The fourth pair of nerves of the medulla oblongata, or nervi trochleares, are long and small, arising behind the eminences called *nates*, from the lateral part of the medullary expansion, which lies above the passage between the third and fourth ventricles of the brain.

*Nervi Trochleares.*

26. From thence they go on each side to the edge of the fold formed by the dura mater, on the extremity of the apophysis petroso, behind the sella sphenoidalis, that is, by the anterior portions of the septum transversum.

27. There, each nerve perforates the edge of the fold above the passage of the nerve of the third pair, and more backward and outward. Afterwards, it runs in the duplicature of that fold, on one side of the nerve of the third pair, along the upper part of the sinus cavernosus, and passes into the orbit through the sphenoidal fissure, and into the musculus trochlearis. Its course is oblique over the other nerves and neighbouring muscles, and it sends off small filaments on each side; appearing to communicate with the first branch of the fifth pair or nervus ophthalmicus.

28. The fifth pair of nerves is very large, and they arise anteriorly from the lateral parts of the transverse protuberance of the medulla oblongata, by a great number of filaments closely united together, which afterwards form two large flat trunks one on each side. Each trunk runs toward the apex of the neighbouring Os Petrosus, where it perforates the dura mater, a little below the edge of the extremity or anterior portion of the septum transversum of the brain.

*Nervi trigemini.*

29. Having detached some filaments to the apex of the apophysis petrosa, or to a kind of sesamoide bone, which is often found near this apex, it enters the sinus cavernosus; and having sent some other filaments to the dura mater, it expands in the sinus, and forms a kind of plexus, or flat irregular ganglion.

30. Afterwards, the trunk is divided into three large branches more or less flattened, which run through the cavernous sinus, being closely connected to the spongy filaments thereof, and bathed in the venal blood, which it contains. These three branches are disposed laterally on one vertical plane, and separate after the manner of a goose's foot.



31. The first branch commonly called *nervus ophthalmicus Willisii*, is the smallest and longest of the three, and enters the orbit through the sphenoidal fissure; for which reason I name it *nervus orbitarius*.

32. The second or middle branch, called also *nervus maxillaris superior*, passes through the superior maxillary foramen of the Os Sphenoides.

33. The third or inferior branch, called likewise *nervus maxillaris inferior*, goes down through the foramen ovale or maxillare inferius of the sphenoidal bone. The two maxillary nerves are united at their origin; for which reason, some anatomists have divided the large trunk into two principal branches; and the second of these branches, into two others.

34. The orbitary or ophthalmic nerve, which is the first branch of the fifth pair, as soon as it enters the orbit, through the sphenoidal fissure, is divided into three rami, one superior or frontal, one internal or nasal, and one external or lachrymal; and before its entry, it sometimes gives and sometimes receives communicating branches. It communicates by a filament or two with the nerve of the sixth pair, and with the nerve commonly called *intercostalis*.

*Nervus orbitarius vulgo ophthalmicus.*

35. The ramus superior or frontalis, which might likewise be termed *nervus superciliaris*, is the most considerable of the three, and runs along the superior part of the orbit close to the membrane which lines it, sending filaments to the fat which surrounds the globe of the eye, to the neighbouring membranes, and to the musculus levator palpebræ.

36. Afterwards it passes through the foramen superciliare, and being divided toward each side, it is spent on the neighbouring portions of the musculus frontalis, orbicularis, and integuments; communicating with a neighbouring ramus of the portio dura of the auditory nerve.

37. The ramus internus or nasalis of the orbitary nerve, runs toward the nose; and near its origin sends off a filament, which communicates with the small lenticular ganglion already mentioned.

38. This filament comes sometimes from the trunk of the orbitary nerve before the division, and adheres to the internal ramus all the way to where the motor communis is divided.

39. This



39. This nasal ramus runs first of all, obliquely over the optic nerve, and under the two muscoli levatores, giving off some filaments to the nearest parts of these muscles. Afterwards it runs between the musculus rectus internus and obliquus major, along the inside of the orbit; and in its passage sends a small filament through the internal orbitary hole, of which hereafter.

40. From thence it passes over the musculus rectus internus, to the great or internal angle of the eye, where it is distributed to the neighbouring parts, that is, to the caruncula and sacculus lacrymalis, to the nearest portions of the musculus orbicularis, superciliaris, pyramidalis nasi, and to the integuments.

41. The small lateral filament which it sends through the orbitary hole, returns into the cranium, running up from before, backward, on one side of the Os Cribrosum, and having reached the forepart of the duplicature of the dura mater, it joins the filaments of the olfactory nerve, on the lamina cribrosa, together with which it passes through the anterior holes of that lamina, and is distributed to the nose.

42. The ramus externus or lacrymalis goes chiefly to the glandula lacrymalis, upon which it is distributed, and from whence it has its name. It seems sometimes to be a branch from the ramus frontalis, and it often arises from the orbitary nerve more posteriorly than the other branches. It adheres closely to the dura mater, and runs obliquely along the inside of the orbit, on the musculus rectus externus, to the glandula lacrymalis.

43. Before it reaches the gland, it sends a small branch to the external lateral part of the orbit, which is sometimes lost in the diploë of the cranium, and sometimes perforates the neighbouring part, either of the Os Frontis, or Os Malaræ, &c.; sending filaments to the nearest portions of the musculus temporalis, orbicularis palpebrarum, masseter, &c. and of the integuments; and it likewise gives filaments to the fat and membrana conjunctiva of the eye.

44. The superior maxillary nerve, the second branch of the fifth pair, goes out of the cranium between the foramen ovale and fissure of the Os Sphenoidale, passing through the foramen rotundum or maxillare superius of the same bone.

*Nervus maxillaris superior.*

45. Immediately after its passage, it sends a filament to the outside of the orbit, which having perforated the Os Malæ, is distributed to the parts which cover that bone, communicates with a neighbouring branch of the portio dura of the auditory nerve; and sends small filaments to the fat in the lower part of the orbit.

46. Soon afterwards, it is divided into three rami, the first of which I name *suborbitarius*, the second, *palatinus*, and the third, *spheno-palatinus*, which last is sometimes only a branch of the first: but still the common division may be retained.

47. The sub-orbitary ramus is the most considerable of the three. It runs in the canal of the inferior portion of the orbit, and goes out by the exterior orbitary hole, which is sometimes double.

48. In this passage it sends downward through the holes of the canal, small filaments which enter the sinus maxillaris, and are distributed to the membrana pituitaria in that sinus, to the substance of the bone, to the alveoli, to the anterior dentes molares, and to the dentes canini and incisores.

49. As it enters the canal, it sometimes gives off a filament to the posterior molares; and among all these filaments, there is at least one, which runs along the upper side of the arch of the palate, to the union of the Ossa Maxillaria.

50. This ramus having passed out of the bony canal, through the foramen suborbitarium anterius, is distributed to the musculus orbicularis palpebrarum, to the neighbouring muscles of the nose and lips, and to the integuments; communicating with a ramus of the portio dura of the auditory nerve.

51. The ramus palatinus of the superior maxillary nerve runs down before the pterygoide apophyses of the Os Sphenoides, in the canal formed by the Os Maxillare and Os Palati; and having passed out of that canal, through the foramen palatinum posterius, it is distributed by several filaments to the glandular coat of the palate, to the septum palati, and muscles belong to that part. Some of these filaments go as far as the foramen palatinum arterius or incisivum.

52. As it runs down in the canal, it is at first a little bent and then sends filaments to the musculus pterygoidæus externus, to the peri-staphilini, and to the arch of the pharynx. It likewise sends other filaments through the small holes in the posterior part or tubercle of the Os Maxillare, to the sinus maxillaris, and posterior dentes molares.

53. The ramus sphenopalatinus passes through the bony hole of the same name, and is distributed to the musculus pterygoidæus internus, to the posterior parts of the nares, to the neighbouring sinus sphenoidalis, and to the tuba Eustachiana.

54. It likewise sends a filament through the foramen pterygoides, which perforates the root of the apophysis pterygoides from behind forward, and joins the nervus maxillaris inferior.

55. The inferior maxillary nerve, the third branch of the fifth pair, is larger at its origin than the other two. It goes out of the cranium by the foramen ovale of the sphenoidal bone, and runs between the two muscoli pterygoidæi, below the great sinus of the lower jaw, where it enters the bony canal of that jaw.

*Nervus maxillaris inferior.*

56. As soon as it leaves the cranium, it sends off four principal branches, and before it enters the canal of the lower jaw, it gives off another to the tongue. The four first branches arise very near each other, so that the size of this nerve decreases very much between the muscoli pterygoidæi.

57. The first branch of this trunk runs up to the temporal muscle, on the inside of which it is distributed, and also between its fibres.

58. The second branch runs behind the condyle of the lower jaw, where it divides into two filaments, which run from within, outward, and communicate with the neighbouring ramus of the portio dura of the auditory nerve, behind the outside of the condyle.

59. At the origin of these two filaments, it sends off a small ramus, which runs up before the external ear toward the temples, giving filaments to the concha of the ear in its passage.

60. The ramus of this trunk passes between the two apophyses



phytes of the lower jaw, perforates the lower part of the temporal muscle, and gives it several filaments.

61. Afterwards it bends downward upon the musculus masseter, to which it is chiefly distributed, giving filaments to the neighbouring integuments and communicating with the portio dura of the auditory nerve on the side of the Os Malæ. It terminates by filaments which go to the musculus buccinator, to the muscles of the under lip, and to the integuments of these parts.

62. The fourth branch of the trunk of the inferior maxillary nerve, is oftentimes no more than a ramus of the third branch, which goes off near its origin. It passes over the musculus pterygoidæus externus, to which it gives filaments, and is distributed to the pterygoidæus internus, and to the nearest portion of the temporalis.

63. It is likewise distributed to the musculus buccinator, to the glands of the mouth and muscles of the lips. Sometimes it sends off a filament, which runs up upon the concha of the external ear.

64. Besides these four branches, several small filaments go off on each side, one of which runs to the foramen pterygoidæum, where it joins a filament of the nervus maxillaris superior, and then continues its course to the membrane which covers the vomer and neighbouring parts of the internal nares.

65. The ramus that goes to the tongue, which may be termed *nervus lingualis* or *hypoglossus minor*, to distinguish it from the hypoglossus major, which belongs to the ninth pair, is detached from the maxillaris inferior, as it passes between the muscoli pterygoidæi, and sometimes a little sooner.

66. It is a very considerable branch, and sometimes nearly as large as the trunk which it accompanies between the two muscles already mentioned, and leaving it a little above the canal of the lower jaw, it runs over the pterygoidæus internus, and gives it some filaments.

67. This ramus lingualis, a little after its origin, communicates with the trunk by a short collateral branch which is sometimes plexiform. At this place it sustains a particular filament, which, according to the common opinion, arises from it, and goes to the internal ear.

68. This



68. This particular filament of the nervus lingualis is supposed, by anatomists, to be a recurrent which runs up backward through the tympanum, and joins the portio dura of the auditory nerve. But as the angle which it makes with the small nervus lingualis, is very acute, and turned forward, there is more reason to think that it comes from the internal ear to that nerve, as we shall see more at length in the description of that organ.

69. Afterwards this lingual ramus passes under the lateral part of the tongue, and over the glandula sublingualis, giving filaments to the neighbouring portions of the muscles of the tongue, and to those of the Os Hyoides and Pharynx.

70. Having communicated, by several filaments, with the extremities of the nerve of the ninth pair, or lingualis major, it enters the substance of the tongue, and terminates near its apex or point.

71. Lastly, the inferior maxillary nerve, before it enters the canal of the lower jaw, sends filaments to the neighbouring portions of the musculus pterygoidæus, internus, digastricus, &c. It likewise detaches a filament or two along the periosteum, to be distributed to the musculus mylo-hyoidæus, and glandula sublingualis. The marks of these filaments often appear upon the bone, all the way from their origin, and sometimes they pass through a small entire bony canal, lying on the surface of the inside of the bone.

72. After the inferior maxillary nerve enters the canal of the lower jaw, it runs under the alveoli, and distributes filaments to each tooth, all the way to the hole near the chin, where it sends another ramus forward, into the diploë, which is distributed to the other teeth, that lie between that hole and the symphysis of the chin.

73. The motores externi, which make up the sixth pair of nerves from the head, are smaller, but yet a little larger than those of the fourth pair. They arise from the union of the medulla oblongata, between the great transverse protuberance, and the corpora olivaria; from whence they advance to the dura mater, and enter it on the extremity of the production of the Os Occipitis behind, and a little on one side of the symphysis of that bone with the Os Sphenoides.

*Nervi motores externi.*

74. Each of these nerves runs afterwards in the cavernous duplicature of the dura mater, on one side of the bottom of the sella sphenoidalis, and of the carotid artery, to which it adheres very closely, and it there communicates with a branch of the fifth pair, by one or two short filaments, as has been already said in the description of the orbitary nerve.

75. Immediately after, and behind this communication, the motor externus sends down a filament, which at first appears to run from before backward like a recurrent, and presently enters the large bony canal of the apophysis petrosa, on one side of the internal carotid artery.

76. This nervous filament, which is sometimes double, is commonly taken for the root or origin of the celebrated intercostal nerve, which I term sympatheticus major; but as it makes an acute angle in an opposite direction, with the nerve of the sixth pair, it seems rather to run up with the carotid artery, and to join that nerve, than to arise from it. The progress of this nerve shall be continued in the description of the great sympatheticus.

77. The nerve of the sixth pair, which I have sometimes seen double or split in two parts, before it enters the dura mater, passes afterwards through the sphenoidal or superior orbitary fissure, to the musculus rectus externus of the globe of the eye.

78. The nerves of the seventh pair, termed *auditorii*, arise from the lateral and posterior part of the great transverse protuberance of the medulla oblongata. Each of these nerves is double, or consists of two ropes, which accompany each other very closely to the foramen auditorium internum of the apophysis petrosa.

79. One of these ropes is small, solid, and anterior, being called the *portio dura*; the other less solid and posterior, called *portio mollis*.

80. The *portio mollis* terminates in the great fossula of the foramen auditorium internum, and is distributed to the organ of hearing through several other small holes. This portion alone deserves the name of the auditory nerve; but the particular description thereof must be referred to that of the ear.

81. The *portio dura* passes through the small fossula of the internal auditory hole, into the winding duct of the apophysis

apophysis petrosa, and goes out by the foramen stylo-mastoidæum, to the face and other neighbouring parts. As it passes through the winding duct or aqueduct of Fallopius, it touches the dura mater at the small opening on the upper side of the apophysis petrosa, where it joins some filaments from the fifth pair.

82. It likewise gives off a filament to the muscle of the stapes; and as it goes out, it gives or receives another filament which passes by the tympanum, and joins the ramus lingualis of the inferior maxillary nerve, as we shall see more particularly in the history of the ear.

83. I chuse to call this portion of the auditory nerve, *nervus sympatheticus minor*; to the description of which I now proceed.

84. The trunk of each nerve of the portio dura, or of the sympathetici minores, having passed through the ductus petrosus Fallopii, and having communicated with the dura mater, *Nervi sympathetici minores.* &c. as has been already said, sends off, at about the sixth part of an inch, from where it goes out at the stylo-mastoidæ hole, two branches, one upward, the other downward.

85. The superior ramus runs up chiefly to the posterior parts of the external ear, to which it is distributed; communicating, as it passes behind the ear, with a ramus of the second pair of the cervical nerves; and forward, with a branch of the maxillaris inferior.

86. The inferior ramus is spent on the three musculi styloïdæi, digastricus, and on the superior extremity of the sterno-mastoidæus, reaching in some subjects as far as the middle of that muscle. In place of these two single rami, small ramifications go out sometimes from the trunk.

87. Afterwards the trunk of the portio dura advances forward, through the parotid gland, to which it gives several filaments; some of these filaments running from without inwards, and surrounding that branch of the external carotid artery, which runs behind the ear. Sometimes, though very seldom, the trunk itself is split to give passage to the artery.

88. This trunk having passed through the parotid gland, behind the angle of the lower jaw, is divided into two large branches, one superior, the other inferior,



89. The superior branch of the portio dura is the most considerable of the two; and having run upwards for about the third part of an inch, it divides into seven or eight rami.

90. These rami are spread superficially, and in an irregular radiated manner, on all the lateral parts of the face, from the hair as low as the under lip, between the ear and nose; distributing a prodigious number of cutaneous nerves.

91. In some subjects these rami, at their first separation, form a kind of plexus which resembles a goose's foot.

92. The first, second, and third rami are distributed to the anterior part of the ear, on the lateral parts of the head, the temporal and frontal muscles, and the neighbouring parts.

93. One of these rami, and sometimes the large superior branch detaches inward behind the condyle of the lower jaw, and before the temporal vein, two or three filaments which communicate with the inferior maxillary nerve.

94. The fourth ramus goes to the foramen superciliare, or supra-orbitarium, giving, in its passage, several filaments to the external lateral and superior parts of the musculus orbicularis palpebrarum; and afterwards communicating with the orbitary nerve, which goes out by the same foramen.

95. The fifth ramus is distributed by small filaments on the lateral part of the cheek, and is partly lost in some small holes at the basis or root of the zygoma; giving likewise some filaments to the external lower part of the musculus orbicularis palpebrarum.

96. The sixth and seventh rami, and likewise the eighth when it is found, are spread on the whole cheek as far as the nose.

97. One of these latter rami passes under or behind the musculus zygomaticus, to which it gives filaments; and then perforating and giving filaments to the middle lower part of the musculus orbicularis palpebrarum, it goes to the inferior orbitary hole in the Os Maxillare, and communicates with the nervus maxillaris superior.

98. The last ramus communicates, by some filaments, with a neighbouring ramus of the large inferior branch of the portio dura.

99. This large inferior branch, which is sometimes less than the superior, runs under the angle of the lower jaw,  
and



and is distributed by several rami to all the inferior lateral parts of the face, and to the neighbouring parts of the throat, where it chiefly terminates by a vast number of cutaneous filaments.

100. The upper rami of the large inferior branch run up on the musculus masseter, to the lower part of the zygomaticus, buccinator, and other muscles of the lips.

101. One of these superior rami communicates with one of the inferior rami of the upper branch, as has been already said; and by the intervention thereof, it communicates likewise in some measure with the suborbital ramus of the nervus maxillaris superior, or that which goes out by the foramen sub-orbitarium.

102. The most considerable of all these rami runs forward along the basis of the lower jaw, sending filaments to the musculus cutaneus. and to the muscles of the under lip, which it perforates near the chin, and there communicates with the nervus maxillaris inferior.

103. The inferior rami run under the lower jaw, giving filaments to the glandula sub-maxillaris, and is distributed to the throat on the musculus cutaneus, intersecting the external jugular vein. One or more of these rami are observed to run down to the middle of the musculus sterno-mastoidæus, where it communicates with a ramus of the second vertebral pair.

104. The nerves of the eighth pair, called by the ancients *par vagum*, and which I have named *nervi sympathetici medii*, arise from the posterior part of the medulla oblongata, from the great transverse protuberance, and from the anterior part of the corpora olivaria, by several separate filaments which are afterwards collected in a fasciculus, that runs toward the anterior part of the foramen lacerum of the basis cranii, where it perforates the dura mater immediately before the extremity of the great lateral sinus.

*Nervi sympathetici medii.*

105. The passage of this nerve is divided from that of the sinus, by a small membranous septum of the dura mater, and by the little bony prominences of the foramen lacerum, mentioned in the description of the skeleton.

106. This great fasciculus does not penetrate the dura mater through a single opening, and as one rope; for several  
of

of the anterior filaments form a particular portion, divided from the main body by a very thin membranous septum.

107. The filaments which compose the large portion, when carefully examined, seem to perforate the dura mater separately, by small holes or pores, which lie very near each other.

108. Though these two portions go out separately, they are looked upon as a common trunk; and the small portion is looked upon as a branch of the great one which lies behind the other, and is esteemed the true trunk of this eighth nerve.

109. As this trunk goes out, it receives backward a small nervous rope, which runs up laterally from the spinal canal, and passing through the great occipital hole on the dura mater, joins this trunk. This small rope is termed *nervus accessorius octavi paris*, or *nervus spinalis*.

110. As the two portions pass through the dura mater and foramen lacrum, they are closely united together, and communicate by filaments which increase the size of the small portion. The large portion communicates likewise with the nervus accessorius, to which it is strongly connected during this passage.

111. The small or anterior portion having passed out of the cranium, separates from the large one as a branch from a trunk; and from thence it has been called *the first branch of the eighth pair*.

112. It is bent in form of an arch, and passing interiorly on the side of the digastric muscle, it supplies the muscoli genio-hyoidæi, those near the basis of the tongue, and those of the pharynx.

113. About two fingers breadth from where it leaves the cranium, this portion sends backward, one ramus which is bent in the same direction like an inverted arch; and detaches from its convex side, at least three filaments. The first, which is sometimes double, communicates with the trunk of this eighth pair, on one side of the ganglion of the intercostal or great sympathetic nerve. The second joins the nervus accessorius, and the third goes to the pharynx.

114. Afterwards this small portion goes to the tongue, as has been said, where it communicates with the extremities of the small nervus hypoglossus, or ramus lingualis of the infe-

rior maxillary nerve, and with those of the great hypoglossus or nerve of the ninth pair.

115. The large portion of the eighth pair, or middle sympathetic nerve, adhering by one side to the first ganglion of the sympatheticus maximus, and by the other, to the hypoglossus major, to both which it gives communicating filaments, sends off, a little below the small portion, another small branch, which goes by several filaments to the pharynx.

116. A little below, or on one side of the union of the eighth pair with the ninth, this portion or trunk forms a ganglion, and gives off a third branch, which runs before the internal carotid artery, to the larynx, musculus laryngis, glandula thyroidea, and muscles of the Os Hyoides.

117. This third branch passes between the cornu of the Os Hyoides and the ala of the cartilago thyroidea, and running in between that cartilage and the cartilago cricoides, it communicates with the extremities of the nervus recurrens, of which hereafter.

118. Afterwards, the large trunk runs down on the fore-side of the first ganglion of the nervus sympatheticus maximus, along the anterior vertebral muscles of the neck, by the side of the carotid artery, and behind the internal jugular vein; being accompanied by the intercostal nerve as far as the last vertebra of the neck.

119. Through all this course, this trunk is invested by a kind of cellular, filamentous, or membranous vagina, common to it with the internal carotid artery, the internal jugular vein, and the great sympathetic nerve. In its passage it gives small rami to the neighbouring parts, to the pharynx, œsophagus, and to the carotid artery and jugular vein. One of these small rami, in its course downward, joins a small ramus of the second cervical pair, and is distributed to the glandula thyroidea.

120. The trunk having reached as low as the larynx and glandula thyroidea, sends out a ramus, which running down on the fore-side of the internal carotid artery, joins a filament from the second ganglion of the intercostal nerve, with which it runs to the plexus pulmonaris.

121. Afterwards, both trunks of the nerves of the eighth pair enter the thorax, before the origin of the subclavian arteries, which they cross, and run behind the lungs, to the œsophagus



sophagus. At this place there is some difference in the distribution of the trunks, which in every other respect is pretty much the same.

122. As the right trunk passes before the subclavian artery, it sends off a considerable branch which bends backward under the artery, and runs up on one side of the aspera arteria; to which, and to the œsophagus, it sends filaments as high as the larynx. This branch is called *nervus recurrens*.

123. This recurrent nerve having reached the larynx, sends rami to the muscles thereof, to the pharynx and glandula thyroides. Then it runs in behind the cornua of the cartilago thyroides, where it joins the extremity of the third branch of the trunk of this eighth pair, communicating with it in the manner already said.

124. The right trunk having given off the recurrent of the same side, runs down on one side of the aspera arteria, and behind the origin of the right lung, where it adheres to the œsophagus; and in this course it sends out several branches.

125. The uppermost branches run on the foreside of the lower extremity of the aspera arteria and bronchia, and are all united to filaments of the great sympathetic nerve, before the bifurcation of the trachea, and likewise to the ramifications of the same nerve from the other side. The other branches which the trunk sends off, as it runs down behind the bronchia and lungs, unite with filaments of the great sympathetic nerve.

126. The left trunk of the eighth pair is ramified in the thorax much in the same manner with that of the right side, with this difference only, that the left recurrent nerve goes out lower than the right; for it passes below the great curvature of the aorta, and behind the ductus or ligamentum arteriosum, and afterwards runs up on one side of the trachea arteria, to the larynx much in the same manner with the other.

127. This difference in the going off of the two recurrens, is the reason why the left trunk does not run down so straight as the right; and the left recurrent gives off some of the branches, which answer to those which come from the trunk itself on the right side.

128. Immediately after the origin of the left recurrent,  
the



the left trunk sends down a branch which goes partly to the plexus pulmonaris, and partly to the œsophagus and aorta.

129. These reciprocal ramifications of both trunks of the eighth pair, and their mutual communications with the filaments of the intercostal or great sympathetic nerve, of which presently, form particular intertextures called *plexus*; the most considerable of which are those called *plexus cardiacus*, and *plexus pulmonaris*.

130. The plexus cardiacus is formed above the lung, on the foreside of the bronchia, and produces a great number of filaments; some of which go to the pericardium, and the rest go through it, round the great vessels, to be distributed to the heart.

131. The plexus pulmonaris is composed of the following ramifications which the two trunks send off, as they run down behind the lungs. Some of the filaments detached from thence, run above the bronchia at their origin; but the greatest part run below, being distributed along with them through the whole lungs.

132. Besides these plexus, the two trunks give off rami to the parts near which they pass; such as the posterior part of the mediastinum, œsophagus, and aorta; and by all these ramifications the trunks are gradually diminished.

133. After having sent off the two plexus, these trunks change in a very remarkable manner. The trunk on the right side runs insensibly backward, as it descends, and to that on the left side, forward in the same manner.

134. In their passage, they send several filaments forward and backward to the œsophagus, which unite at different distances, both with the filaments from the same trunk, and with the like filaments from the trunk on the other side; and the posterior filaments from the left trunk, are in some subjects more considerable than the anterior ones from the right trunk.

135. These repeated divisions and re-unions which represent a kind of plexus, cause the original trunks to degenerate in some measure, into two particular ropes, one anterior, the other posterior, which are called *nervi stomachici*.

136. The posterior stomachic nerve arises principally from the right trunk, and the anterior, from the left trunk; and accordingly the posterior rope is oftentimes much stronger

than the anterior, because of the difference between the filaments, of which each of them is made up.

137. These two stomachic ropes pass along with the extremity of the œsophagus, through the opening in the small muscle of the diaphragm, and are distributed on the stomach. The anterior rope is spread on the upper, or, as it is commonly called, the fore-side, and the posterior, on the lower or back-side.

138. The ramifications of both ropes communicate with each other, and form particular intertextures chiefly near the upper orifice of the stomach, and along the small curvature, all the way to the pylorus; by all which a kind of plexus is formed, called *coronarius stomachicus*.

139. This coronary plexus thus formed, sends off near its origin two small ropes; one of which seems to come chiefly from the great anterior stomachic rope, the other from the posterior rope. These two small ropes unite near the trunk of the hepatic artery, which having accompanied for a little way, they are divided into two very short branches.

140. These two branches run presently afterwards to the right and left hands, immediately above the transverse rope, which forms the communication between the semilunar ganglions of the two great sympathetic nerves; and they terminate by uniting with this rope in a triangular form.

141. In this manner end the nerves of the eighth pair, or the sympatheticus medius of each side, by contributing, together with the sympatheticus maximus, to the formation of several plexus in the abdomen, which are ascribed principally to the last named nerve. Among these, are the plexus hepaticus, splenicus, mesenterici, and even the renales.

142. We see likewise that these two great pairs of nerves have a perpetual correspondence through all the viscera of the abdomen, as well as in the thorax, as we shall shew more particularly hereafter.

143. The nervi accessorii of the eighth pair arise by several filaments from both sides of the medulla

*Nervi accessorii  
octavi paris.*

spinalis of the neck, sometimes higher, and sometimes lower. Each of them runs up between the two nervous planes which come out from the spinal marrow, to form the vertebral nerves, and they gradual-

ly

## OF THE HUMAN BODY.

ly increase in their course upwards by means of several filaments which they receive from the posterior nervous plane.

144. Having reached above the first vertebra, each nerve is fixed to the backside of the ganglion of the nervus sub-occipitalis, or that of the tenth pair; and having, at the upper part of this adhesion, received two filaments from the posterior portion of the medulla, they part from the ganglion, and continue their course upward. I have sometimes found these two filaments without any communication with the ganglion, or with the anterior plane; so that they seem rather to belong to the nervus accessorius, than to the sub-occipitalis.

145. They enter the cranium by the great occipital foramen; and, having communicated with the origin of the sub-occipitalis, or nerves of the tenth pair, and with the great hypoglossi or ninth pair, they return out of the cranium with the nerves of the eighth pair, or sympathetici medii, with which they communicate in their common passage through the cranium.

146. As soon as they get without the cranium, each of them gives off a considerable branch, which divides into two. One is very short, and immediately joins the trunk of the eighth pair; the other, which is longer, joins the small portion or first branch, which goes to the tongue. They likewise communicate with the great hypoglossus and sympatheticus on each side.

147. Afterwards the nervus accessorius runs backward, and perforating the musculus sterno-mastoidæus, runs to the trapezius, on which it is distributed and terminates after having supplied the rhomboides. In this course, it communicates with the first three pairs of the cervical nerves, and gives rami to the glands of the neck, to the musculus angularis of the scapula, the complexus, occipitalis, and to the integuments.

148. The ninth pair of nerves as they are commonly called, or the *par linguale*, arises on each side, between the corpora pyramidalia and olivaria, by several small filaments, which uniting together, form ordinarily two small ropes on each side. These two ropes perforate the dura mater, by two small separate holes, and afterwards soon unite in one trunk on

*Nervi hypoglossi  
externi, five ma-  
jores.*



each side, which goes out of the cranium, by the anterior condyloide hole of the *Os Occipitis*.

149. As soon as they leave the cranium, each trunk adheres very closely to the outside of the trunk of the eighth pair and to that of the tenth. From thence each nerve passes on the foreside of the large ganglion of the *sympatheticus maximus*, and runs between the internal jugular vein, and the neighbouring carotid artery, and then to the tongue on one side of the digastric muscle.

150. In its passage between the jugular and carotid, it sends down a branch to the jugular glands, *musculus cutaneus*, &c. and behind the first ganglion of the *intercostalis*, it detaches another, which runs down till it joins the nerve of the eighth pair, or *sympatheticus medius*. A little afterwards, it gives off a third to the *musculus omo-hyoidæus*, *sterno-hyoidæus*, and to the small muscles of the larynx.

151. Afterwards this trunk of the ninth pair bends near the angle of the lower jaw, and runs forward between the *musculus cerato-basio-glossus* and *mylo-hyoidæus*, under the *genio-glossus*; to all which muscles it gives filaments, and it is afterwards lost in the tongue, communicating with the filament of the *ramus lingualis* of the inferior maxillary nerve, and with the *ramus* of the same name belonging to the eighth pair.

152. Before it bends near the angle of the lower jaw, a little below the *apophysis styloides* of the *Os Temporis*, it communicates with the first cervical pair, and then sends a small ramus to the larynx, and another more considerable one, which runs down behind the *musculus sterno-mastoidæus*, on the anterior muscles of the neck, and communicates with the first and second vertebral pairs.

153. This last ramus communicates likewise with the *portio dura* of the auditory nerve, and with the following vertebral pairs; after which, it terminates chiefly in the *musculus sterno-hyoidæus*, and *sterno-thyroidæus*.

154. The sub-occipital nerves, or those of the tenth pair, arise a little lower, and more laterally than the former, at the extremity of the *medulla oblongata*, opposite to the posterior part of the condyloide apophyses of the *Os Occipitis*.

155. They come on each side from the anterior part of the medulla,



medulla, by a single plane of small filaments, and communicate, by some collateral filaments, with the first cervical pair, before they pierce the dura mater.

156. They pierce the dura mater directly outward, opposite to their origin, at the same place where the vertebral arteries perforate it inwards; both going, in a manner, through the same holes, and the nerves lying below the arteries.

157. Afterwards they run down in the duplicature of the dura mater, and emerge again under the edge of the great occipital foramen, crossing the elongation or occipital funnel of that membrane.

158. Having passed out of the cranium, each of them runs to the posterior notch of the superior oblique apophysis of the first vertebra of the neck, in which it runs from behind forwards, in company with the vertebral artery, which lies above it in the same notch.

159. Where it leaves this notch, it forms a ganglion, and gives filaments to the muscoli recti and obliqui of the head, besides one which runs down in the transverse foramina of the vertebrae of the neck, along the blood vessels which lie there.

160. Having formed this ganglion, and sent off these filaments, it turns forward and downward over the transverse apophysis of the first vertebra, forming a sort of arch with an ascending ramus of the first cervical pair.

161. This arch surrounds the fore-part of the transverse apophysis, and has several communications with the first ganglion of the great sympathetic nerve, and by its convex side, adheres very closely to those of the eighth and ninth pairs.

162. The superior part of this arch or ganglion sends up a considerable nerve, which is increased by the addition of a short ramus belonging to the first cervical pair, and running upward and backward on the convex side of the Os Occipitis, is distributed to the superior and lateral parts of the head, by several ramifications. This branch is termed *nervus occipitalis*.

163. These sub-occipital nerves have this in common with the other nerves of the medulla oblongata, that each arises only by one anterior fasciculus of filaments, without any posterior fasciculus, as in the vertebral nerves. We sometimes observe, indeed, a small posterior single filament on each side; but

but this seems rather to belong to the *nervus accessorius* of the eighth pair, than to the tenth.

164. The particular description of the course, division, and great extent of the *nervi sympathetici maximi*, commonly called *intercostales*, will come in most properly after that of all the vertebral nerves, with which they almost universally communicate.

*The vertebral nerves  
in general.*

165. The vertebral nerves are all those which arise from the medulla spinalis, and go out from the great canal of the spine, through the lateral foramina formed by the corresponding notches in the vertebræ.

166. The original trunk of each vertebral nerve arises commonly by two flat fasciculi of medullary or nervous filaments, one anterior, the other posterior. These two fasciculi on each side run towards each other, and perforate laterally the production of the dura mater; after which, they presently unite in a kind of ganglion, from which the trunk is produced.

167. I reckon the vertebral nerves by pairs, in the common manner, beginning by those which pass between the first and second vertebra. This enumeration agrees with that of the vertebræ themselves; there being seven pairs of vertebral nerves belonging to the neck, termed *cervicales*; twelve to the back, called *dorsales*; five to the loins, named *lumbares*; and five or six to the Os Sacrum, called *sacri*.

168. This distribution is fixed chiefly by the dorsal nerves, called *costales*; for there is exactly the same number of these nerves as of ribs, and the first pair of costal nerves passes between the first and second vertebræ of the back.

169. This is not the proper place to take notice, that the spinal marrow from which all these nerves arise, does not go down so low as the bony canal of the spine, &c. These observations must be referred to the description of the brain, of which this medulla is the true continuation.

170. The first pair of cervical nerves passes between the first and second vertebra of the neck; lying more backward than the subsequent pairs, and having larger ganglions.

171. The trunk of each of these nerves sends out anteriorly a small ramus, which runs up on the foreside of the transverse

verse apophysis of the first vertebra, and forms a communicating arch with the small descending ramus of the nervus sub-occipitalis of the same side already mentioned; and consequently communicates likewise with the great sympathetic nerve.

172. Posteriorly it sends out a considerable branch, which is soon increased by a communicating branch from the second cervical pair. This branch communicates also with the sub-occipitalis, and afterwards passes between the musculus complexus and rectus minor posticus of the head; and bending backward, is distributed to the other small posterior muscles of the head, and to the splenius, complexus, and trapezius. It passes next, over these muscles, to the occiput, where it is ramified backward, upward, and forward to the musculus occipitalis, and temporalis of the same side.

173. It likewise gives off a filament, which dividing into two, sends up one portion to the musculus sterno-mastoidæus, round the nervus accessorius octavi paris, or sympatheticus medius, and running afterwards behind that muscle, it is distributed to the splenius.

174. The other portion of this filament runs downward, and bending in a particular manner, communicates with the second cervical pair, and with the sympatheticus major. It likewise sends smaller filaments to the anterior muscles of the head and neck, and to the sterno-mastoidæus and splenius.

175. One of these small filaments communicates with the great nervus lingualis, or ninth pair from the brain, and goes to the musculus sterno-hyoidæus, thyro-hyoidæus, and thyroide glands.

176. The second cervical pair passes between the second and third vertebra of the neck; and as it goes out, communicates forward with the great *Second pair of cervical nerves.* ganglion of the sympatheticus maximus, upwards with the first cervical pair, and downward, with the third.

177. Afterwards the trunk on each side is divided into several branches; but from the place of its union with the first pair, it sends off, first of all, one filament, and then another from where it joins the third pair.

178. Lower down, these two filaments unite into one, which runs down along the internal jugular vein, and then forming a considerable arch, runs up along the carotid artery,

ry, as high as the parotid gland, where it joins and communicates with the trunk of the ninth pair of the medulla oblonga. A filament is detached from the curvature or arch, which is spent on the musculus coraco-hyoidæus, sterno-hyoidæus, and sterno-thyroidæus.

179. Opposite to the sterno-mastoidæus, the trunk sends off a branch, which, behind, that muscle, communicates with the nervus accessorius of the eighth pair, after the manner of a plexus.

180. This branch runs afterward behind the musculus splenius, perforates the upper portion of the trapezius, between the great occipital nerve and the ear, and ascends to the lateral part of the occiput, where it communicates with its fellow from the other side. It is distributed on each side, to the muscles just mentioned, and to the angularis scapulæ.

181. The trunk of this second cervical pair sends down other branches to the middle part of the musculus trapezius, sterno-mastoidæus, and neighbouring vertebral muscles; and sometimes we observe a communication backward, between this trunk and the third cervical pair.

182. Having given off these branches, this trunk advances toward the posterior edge of the middle portion of the sterno-mastoidæus, upon which it bends from behind forward, sending out several branches. The first branch runs downward and backward, and is distributed by several rami to the musculus scalenus, transversalis colli, &c.

183. The second branch communicates with the third cervical pair, at the place where this pair produces the diaphragmatic nerve, to the formation of which it contributes. The third branch is only a filament which running upward, communicates with one or two filaments of the inferior branch of the portio dura nervi auditorii.

184. The extremity of this curvature on the foreside of the sterno-mastoidæus, is divided into two branches, one of which runs upward, the other downward. The superior branch ascends on this muscle, to the lower part of the ear, sending one ramus behind the ear, and another to the parotid gland, where it joins the trunk of the portio dura of the auditory nerve, and runs up on the foreside of the ear.

185. The inferior branch runs from behind forward, to be ramified on the musculus cutaneus, and distributed to the integuments



integuments of the throat, in which it is lost near the larynx, having first given rami to the musculi sterno-hyoidæi. It likewise communicates with a descending branch of the portio dura, and with another of the ninth pair from the brain.

186. Near its origin, this inferior branch sends down a ramus on the backside of the sterno-mastoidæus, gives other rami to the jugular glands, to the fat and integuments of the lateral and lower part of the neck, and passes before the middle portion of the clavícula, below which it is lost in the lateral integuments of the thorax.

187. The third cervical pair passes between the third and fourth vertebræ of the neck, and communicates upward with the second pair, downward with the fourth, and forward with the great sympathetic nerve, and with a filament from the ninth pair of the medulla oblongata. It communicates likewise with the nervus accessorius of the sympathicus medius, by a filament which goes to the musculus trapezius.

*Third pair of cervical nerves.*

188. Each trunk of this third pair sends several branches to the anterior, posterior, and lateral parts of the neck, that is, to the muscles, glands, membranes, fat, and skin, all the way to the neighbouring upper parts of the thorax and shoulder.

189. Among the posterior branches, there is one which goes to the musculus supra-spinatus, and passing over the notch in the superior costa of the scapula, gives filaments to the extremity of the omo-hyoidæus; and there is another small one, which, in its passage to the musculus trapezius, communicates with a filament of the nervus accessorius of the eighth pair.

190. Of the middle branches, some go to the jugular glands, to the musculi subclavii, to the neighbouring portions of the pectoralis, deltoides, and trapezius, and to the integuments which lie thereabouts.

191. Among the anterior branches, there is one which being strengthened by a ramus from the second cervical pair, unites lower down with another ramus of the fourth pair, and thus forms the nervus diaphragmaticus.

192. This diaphragmatic nerve runs on the foreside of the musculus scalenus, and enters the thorax behind the anterior extremity of the clavícula, receiving immediately af-

terwards, a filament from the first dorsal pair, and communicating with the great sympathetic. It runs down obliquely forward, before the subclavian artery, and on one side of the nervus sympatheticus medius, near the origin of the recurrent.

193. In the thorax, this diaphragmatic nerve runs down immediately before the origin or root of the lung, along one side of the pericardium, to which it adheres very closely, and then running a little backward, it soon enters the diaphragm.

194. It is distributed by numerous ramifications on the great muscle of that organ, sending likewise some filaments to the lower portion, by which it communicates with the great sympathetic nerve, and with the neighbouring plexus of the abdomen.

195. The right diaphragmatic nerve runs along the vena cava superior, and on that account appears to be situated more anteriorly than the left.

196. This left diaphragmatic nerve lies first of all a little backward, toward the trunk of the aorta, and afterwards runs in a longer course than the right, being bent, in order to pass by that portion of the pericardium, which answers to the apex of the heart; for which reason it is longer than the right. From thence it is bent backward, and distributed to the diaphragm in the same manner with the other.

197. The last four cervical pairs pass between the portions of the musculus scalenus, being in general larger than the three former. They are united by their trunks, and together with the communicating branch of the third pair, and trunk of the first dorsal pair, they form a very large plexus, which is in a manner inclosed in a membranous vagina, and produces six considerable ropes, like so many particular trunks, which are distributed to the upper extremity, and go by the general name of *nervi brachiales*.

198. The brachial nerves consist of six ropes on each side, as has been said; and in the year 1697, M. Duvernay gave to five of them, the following names: *nervus musculo-cutaneus*, *five cutaneus externus*, *medianus*, *cubitalis*, *cutaneus internus*, and *radialis*, taking for a branch of the radialis that nerve

*The last four  
pairs of cervical  
nerves in general.*

*The brachial nerves  
in general.*

nerve which I look upon as the sixth principal rope, and which I name *axillaris*, or *articularis*.

199. These six ropes do not arise separately; and their origin is so complicated, that it is not an easy matter to determine it; but in general, it seems that each of the five vertebral pairs which form the great plexus, contributes to the formation of each brachial rope.

200. Four of these nerves arise anteriorly from the great plexus, *viz.* the musculo-cutaneus, medianus, cubitalis, and cutaneus internus; and the other two, the radialis and axillaris, arise posteriorly.

201. The five vertebral pairs form the large plexus in the following manner.

202. The fourth and fifth cervical pairs, about an inch or more after they go out, unite into one common trunk. The seventh cervical and first dorsal pair unite likewise into one trunk, very near their origin. The sixth cervical pair runs singly for a considerable space, between the two other trunks, and afterwards is increased by a communicating portion which it receives from each of them.

203. These five large vertebral nerves on each side, thus mingled, interwoven, and complicated together, divide again, and are disposed in a quite different manner from what is ordinary, forming the six brachial ropes. There is, however, some variety in this plexiform union and mixture.

204. The manner in which the six brachial nerves arise from the great plexus, is commonly as follows.

205. The nervus musculo-cutaneus is formed by the union of the fourth and fifth cervical pairs, and by their collateral communication with the third and sixth pairs.

206. The medianus comes on one side, from the union of the sixth cervical pair, with the fourth and fifth; and, on the other, from the union of the seventh pair, with the first dorsalis. These two unions form an acute angle, the apex of which produces the median nerve.

207. The cubitalis goes out from the union of the seventh cervical, with the first dorsal pair, a little nearer the lower side of the angle of the medianus.

208. The cutaneus internus arises much in the same manner.

209. The radialis is the largest of the six, and goes out from

from the apex of another nervous angle, the upper side of which is formed by the union of the trunks of the fourth, fifth, and sixth pairs; and the lower side by the union of the seventh cervicalis and first dorsalis.

210. The axillaris goes out close to the radialis, chiefly from the upper side of the nervous angle, and it communicates with all the rest.

211. Besides the great brachial nerves, several small branches go out from each of the last four pairs; and it will be proper to describe all these branches, together with the trunks they belong to, before we go on to the distribution of the brachial nerves.

212. The fourth cervical pair passes between the fourth and fifth vertebræ of the neck, and communicates above with the third pair, below, with the fifth, and forward with the great sympathetic.

*Fourth pair of cervical nerves.* 213. It sends several rami to the musculus scalenus, angularis scapulæ rhomboides, trapezius, and pectoralis major; and likewise gives off a filament, which contributes to the formation of the nervus diaphragmaticus. Afterwards it advances a finger's breadth without any ramification, and joins the trunk of the fifth cervical pair.

214. At the place of this union, or a little before, it gives out a pretty considerable branch, which having sent a filament to the musculus subscapularis, passes through the small notch in the superior costa of the scapula, and gives other filaments to the supra-spinatus. This ramus runs afterwards under the last named muscle, and under the acromium, to the infra-spinatus, and teres minor.

*Fifth pair of cervical nerves.* 215. The fifth cervical pair passes between the fifth and sixth vertebræ of the neck, communicating with the fourth and sixth pairs, and with the great sympathetic.

216. Afterwards each trunk sends forward a ramus, which uniting with a like ramus from the sixth pair, is distributed to the musculus scalenus, to the surface of the pectoralis major, and to the neighbouring integuments. This trunk sends off likewise near its origin another ramus, which runs down behind the origin of the sixth pair, from which it receives a small communicating filament.

217. Being



217. Being thus strengthened, it runs down on the outside of the thorax, and is distributed to the muscles situated there; passing first under the two pectorales, and then between the serratus major and subscapularis.

218. Afterwards continuing its course downward, it reaches the anterior, middle, and almost the lower part of the latissimus dorsi at the third false rib, and terminates in this muscle, and in the integuments.

219. The sixth and seventh cervical pairs having passed in the common manner under the sixth and seventh vertebræ of the neck, and having communicated with the other nerves near them, send several filaments to the neighbouring parts.

*The last two pairs of cervical nerves.*

220. The branch of the sixth pair, which unites anteriorly with a like branch of the fifth pair, to be distributed on the thorax, as has been said, sends down a filament, which together with another common to the seventh cervical, and first dorsal pair, forms a kind of arch, under which the axillary artery passes.

221. All these nerves give filaments to the neighbouring integuments; and some go likewise to the axillary glands.

222. The musculo-cutaneous nerve which naturally lies on one side of the cutaneus internus, arises from the union of the fourth and fifth cervical pairs, and partakes of their lateral communication with the third and sixth pairs.

*Nervus musculo-cutaneus.*

223. Having reached the upper extremity of the musculus coraco-brachialis, it perforates it obliquely from above downward, and gives it several filaments. Afterwards it runs down on the arm behind, and under the biceps, to both portions of which it gives rami.

224. Having got from behind the biceps, it runs from within outward, between the lower extremity of that muscle and of the brachialis, which it likewise supplies. In the fold of the arm, it reaches the skin immediately behind the vena mediana, and there it becomes a true nervus cutaneus. From thence it runs along, between the supinator longus and the integuments, on the inside of the cephalic vein, all the way to the thumb.

225. It is distributed to the integuments on the fore-side of the carpus to those of the thumb, and of the convex part

part of the hand. Before it reaches the wrist, it passes over the cephalic vein, and communicates at the thumb with a branch of the radial nerve.

226. The nervus medianus lies between the musculo-cutaneus and cubitalis. It arises from the union of three branches, one belonging to the sixth cervical pair, one to the seventh, and one to the first dorsalis. In some subjects it is formed by the union of two principal branches; one of which comes from the union of the first dorsalis with the last cervicalis, the other from the union of the fourth, fifth, and sixth cervicalis.

227. It runs down on the arm, along with the brachial artery, under the inner edge of the biceps, having first passed behind the inferior insertion of the coraco-brachialis, and reaches the fold of the arm between the lower extremity of the musculus brachialis and pronator teres; giving filaments in its passage to all these muscles on both sides.

228. It passes behind the ramus medianus of the basilic vein, as it approaches the inner condyle; and then runs backward cross the pronator teres, and downward between the perforatus and perforans, to which it gives rami.

229. Below the pronator teres, it sends off a particular ramus, which runs along the interosseous ligament, behind the pronator quadratus, all the way to the wrist, giving filaments to that muscle.

230. Afterwards, having detached some cutaneous ramifications, the trunk passes under the internal transverse ligament of the carpus, to the palm of the hand, where it sends off numerous rami to the musculus thenar and antithenar, two to the lateral concave parts of the thumb, two to those of the index, two to those of the middle finger, and one to the nearest side of the ring-finger, after having communicated with a ramus of the cubital nerve. These rami go all the way to the ends of the fingers, supplying the integuments, ligaments, and tendons.

231. The cubital nerve arises from the union of the seventh cervical, with the first dorsal pair; and communicates with the lower root of the median vein.

232. It runs down on the inside of the arm, along the musculus

musculus anconæus maximus, between the brachial artery and the basilic vein; sending off only small filaments to the neighbouring muscles and integuments.

233. It runs in between the inner condyle of the Os Humeri and the olecranon, where it is covered only by a kind of ligament, and by the common integuments; and this is what makes strokes upon the elbow so painful, even all the way to the little finger where this nerve ends.

234. Afterwards it runs down on the musculus ulnaris internus, giving filaments to the neighbouring muscles, to the pronator quadratus and integuments; and at the lower extremity of the ulna, it is divided into two branches, one large, the other small.

235. The large branch, which may be reckoned the continuation of the trunk, passes on one side of the Os Pisiforme, under the great transverse ligament of the carpus, to that part of the palm of the hand, which answers to the last two fingers, where it gives some filaments to the integuments and ligaments of the carpus.

236. Afterwards it divides into three particular branches, one of which forms a kind of arch, being distributed to the neighbouring small muscles of the thumb, and to the interossei; the second is bifurcated, and goes to the corresponding lateral concave parts of the ring and little fingers; and the third goes to the opposite lateral part of the little finger, and to the neighbouring muscles.

237. The small branch is turned outward, behind the tendon of the ulnaris externus, and goes to that part of the back of the hand which answers to the last two fingers. It is distributed to the lateral convex parts of these two fingers, much in the same manner as the other branch, to the lateral concave parts. It likewise supplies the musculus hypothenar, metacarpus, and the integuments, and communicates with a ramus of the nervus medianus.

238. The internal cutaneous nerve is very small, and arises from the union of the seventh cervical and first dorsal pairs, but chiefly from the latter. It runs over the other brachial nerves, and passes down on the inside of the arm, between the muscles and integuments.

*Nervus cutaneus internus.*

239. It divides first of all into two branches, which accompany

company each other very closely, as far as the inner condyle on one side of the vena basilica, being covered by the ramus medianus of that vein.

240. One of these branches runs down under the integuments, which cover the musculus radialis internus and ulnaris gracilis, and is afterwards ramified on the skin, which covers the wrist and beginning of the palm of the hand.

241. The other branch runs a little more backward along the integuments which cover the musculus ulnaris internus and ulna, upon which it is ramified all the way to the little finger.

242. The radial nerve, so called, because it accompanies the radius and the radial artery, arises from the union of three compound branches, one of which comes from the united trunks of the fourth and fifth cervical pairs; the second from the single trunk of the sixth pair, and the third from the united trunks of the seventh cervical, and first dorsal pairs.

243. The trunk of this nerve lies deeper than the rest; and it runs first of all, from before backward, bending round the Os Humeri, between the musculi anconæi and that bone.

244. This curvature is oblique and contorted, answering to the impression observable on the bone; and above it the radial nerve gives branches to the three anconæi, especially to the longus and externus. Afterwards it turns from behind forward, between the anconæus externus and brachialis.

245. It sends off from the curvature or arch, some cutaneous rami, the most considerable of which goes to the external condyle of the Os Humeri, and is distributed to all the integuments which cover the radius on the fore and outer sides, and to those which cover the exterior parts of the carpus and back of the hand, all the way to the thumb.

246. At the fold of the arm, the radial nerve turns outward, and runs down between the lower extremity of the musculus brachialis and upper extremity of the supinator longus, giving rami to these and to the neighbouring muscles.

247. Having reached the extremity of the radius, it divides into two, or rather sends off a large branch, which passes



passes between the radius and supinator longus, below the middle of the bone, where it runs in between the supinator longus and radialis.

248. This branch accompanies the external radial artery near the integuments, and having got to the lower part of the radius, it is distributed in three rami, to the convex lateral parts of three fingers and an half.

249. One ramus goes to the internal lateral part of the thumb, and to the integuments. The second is divided into two for the external lateral part of the thumb and anterior lateral part of the index, giving filaments in its passage to the integuments of the metacarpal bones. The third ramus is divided into several lesser ramifications which go to the posterior lateral parts of the index, to both sides of the middle finger, and to the anterior lateral part of the ring-finger.

250. Through all this course, this branch supplies the integuments and interosseous muscles.

251. The trunk or largest branch of the radial nerve passes between the upper extremity of the radius and musculus supinator brevis; and, in its passage, supplies this muscle, the anconæus minimus, supinator longus, and radialis externus.

252. Afterwards it is lost in the extensor digitorum communis, and in the muscles of the carpus and thumb, having first communicated with a ramus of the musculo-cutaneous nerve.

253. The axillary or articular nerve arises from the last two cervical pairs, and sometimes seems to be no more than a large branch of the nervus radialis. *Nervus axillaris.* It runs in the hollow of the axilla, behind the head of the Os Humeri, between the musculus teres major and minor; and bends or turns from within outward and backward, round the neck of that bone, running between the articulation and the upper extremity of the anconæus longus, to the deltoides.

254. It is divided into several rami, which go chiefly to the upper and lower parts of the deltoides, upon which they are ramified, supplying, in their passage, the sub-scapularis, the upper extremity of the anconæus longus, teres major and minor, and supra-spinatus. It likewise gives some nerves to the latissimus dorsi, and anconæus externus.

*Nervi dorsales  
five costales.*

255. The dorsal or costal nerves consist of twelve pairs, as has been already said, and they deserve more justly to be called *intercostales*, than the great sympathetic nerve to which that name has been commonly given.

256. They have this in common with each other, that as soon as they leave the vertebræ of the back, before they begin to accompany the ribs, they send out two filaments anteriorly, which communicate with the great sympathetic nerve, and several filaments backward, to the vertebral and other muscles.

257. Each of these twelve pairs is numbered from the vertebra, under which it goes out; thus the first pair is that which passes under the first vertebra of the back, and so of the rest.

258. The first pair enters the composition of the *nervi brachiales*, as has been said, and, together with the second pair, it sends off the *rami thoracici*.

259. The seven superior pairs run along the under sides of the true ribs, all the way to the sternum; being distributed to the intercostal muscles, which they perforate likewise from within outward, to go to the *serratus major*, *pectorales*, and external integuments.

260. The seventh pair having reached the cartilaginous portion of the seventh true rib, runs down to the broad muscles of the abdomen, to which it is distributed.

261. The lowest five pairs leave the extremities of the false ribs, and go to the muscles of the abdomen.

262. The eleventh pair gives likewise some filaments to the diaphragm, and then runs in between the *musculi transversales* and *peritonæum*.

263. The twelfth is distributed to the *transversales* and *obliqui interni*.

264. All these nerves send numerous ramifications through the muscles, to the integuments; which form the cutaneous nerves of the thorax, of the upper two regions of the abdomen, and of the superior portion of the loins.

*Nervi lumbares.*

265. All the five pairs of lumbar nerves send filaments backward to the vertebral muscles, communicate with each other, and with the great sympatheticus

sympatheticus on each side, and are covered by the psoas muscle.

266. The branches which communicate with the great sympathetic nerve are long, because they advance forward a considerable way on the bodies of the vertebræ lumbares.

267. The lumbar nerves are denominated from the vertebræ, under which they pass.

268. The first pair passes between the first and second vertebræ of the loins, and each receives a communicating branch from the last dorsal pair, and gives out another to the second lumbar pair, or to a branch thereof.

*First pair of lumbar nerves.*

269. Each trunk communicates with the great sympathetic, by a pretty long ramus; and afterwards gives out three branches, one posterior, and two anterior, whereof one is external and large, the other internal and small.

270. The posterior branch perforates the musculus quadratus lumborum, runs in between the back parts of the oblique muscles of the abdomen, pierces the obliquus externus, and is distributed to the skin all the way to the clunes. This branch supplies also the vertebral muscles, and sacrolumbaris.

271. The external anterior branch perforates the upper extremity of the musculus psoas, obliquely outward, passes over the quadratus lumborum, and runs along the crista of the Os ilium, to the anterior spine of that bone.

272. It gives filaments to the abdominal muscles, and supplies the fascia lata, neighbouring integuments, and those of the anterior part of the outside of the thigh, and the inguinal glands.

273. The internal anterior branch perforates the psoas almost at the same place with the former, but a little more forward; and then passes over the musculus iliacus, to the beginning of the ligamentum Falloppii, where it unites with the other anterior branch, and by this union forms a nerve, which runs along that ligament, and along the inside of the aponeurosis of the obliquus externus, all the way to the opening, commonly called the *ring* of that muscle.

274. This nerve goes out by that opening, and afterwards divides into several cutaneous filaments, which go to the pubis and integuments of the parts of generation in both sexes,



&c. It likewise supplies the spermatic ropes, and those vascular ropes falsely called the *round ligaments*.

275. Besides these branches, the trunk of this first pair, near its union with the second, sends out two small rami, closely united together, which run down behind the psoas muscle, over one tendinous insertion of the small muscle of the diaphragm, in the third vertebra of the loins, and communicate with the great sympathetic nerve.

276. These two rami accompany each other in this manner, all the way to the ligamentum Falloppii; from whence one goes to the testicles in company with the spermatic vessels; the other passes under the ligament to the skin and glands of the inguen.

277. At the place of this division, the trunk sends a branch directly downward, which joins the second lumbar pair, or rather a branch thereof; and afterwards contributes to the formation of the large rope, termed *nervus cruralis*.

278. The trunks of the second pair of lumbar nerves, go out between the second and third vertebrae of the loins; and having communicated with the first pair, and with the great sympathetic nerve, each trunk gives off several small filaments to the neighbouring parts of the musculus psoas, and a large ramus backward, to the quadratus lumborum, sacro-lumbaris, longissimus dorsi, and neighbouring vertebral muscles, the quadratus having first been perforated by it.

279. Afterwards the trunk sends out a small branch, which near its origin joins a descending ramus of the first pair already mentioned. Being thus strengthened, it perforates the head of the psoas, runs along that whole muscle, to the fissure of the obliquus externus, and is distributed to the inguinal glands, to the fat and scrotum in males, and in females to the labia.

280. The same trunk sends out two other branches, which accompany each other, and likewise a small ramus between the origins of these two, which goes to the upper part of the psoas. These two branches perforate the psoas in different places; and afterwards continuing still near each other, they pass under the upper part of the ligamentum Falloppii, and so go out of the abdomen.

281. As they go out, they unite and form one nerve, which



which is distributed by several rami to the inguinal glands, the aponeurosis cruralis, and integuments of the fore-part of the thigh, all the way to the knee.

282. Some of these rami unite with those of the *nervus cruralis*; some are distributed to the integuments on the inside of the thigh; and one accompanies the crural artery, over one branch of which, it runs in form of an arch.

283. This trunk sends out oftentimes another ramus, which unites with one from the third, and one from the fourth pairs, into a particular rope, which passing to the obturator muscles, is named *nervus obturator*.

284. Afterwards this trunk runs downward, and having given a ramus to the middle portion of the psoas muscle, joins the trunk of the third pair, and contributes to the formation of the crural nerve.

285. The trunks of the third pair of lumbar nerves go out between the third and fourth vertebræ of the loins. Each trunk communicates above with *Third pair of lumbar nerves.* the second pair, before, with the great sympathetic nerve, and below, joins the trunk of the fourth pair. It sends a considerable ramus backward, between the transverse apophyses which goes to the vertebral and other neighbouring muscles.

286. Before it unites with the fourth pair, it sends a considerable branch downward, and having received a communicating branch from the second pair, unites with one from the fourth pair, and forms the obturator nerve.

287. It detaches likewise another large branch which runs down between the musculus iliacus and psoas, and joins the crural rope on the outside of the lower part of the muscle last named. It may be reckoned a sort of *nervus accessorius* to the cruralis.

288. As the trunk runs along the psoas, it gives off filaments both to that, and to the iliac muscle; and sends down a ramus, which passes under the ligamentum Falloppii, to the musculus pectineus; and lastly, having joined a branch of the second pair, it unites with the fourth pair, to form the *nervus cruralis*.

289. The trunks of the fourth pair of lumbar nerves go out between the fourth and fifth vertebræ of the loins; and each communicates

*Fourth pair of lumbar nerves.*

above,

above, with the third pair, and before, with the great sympathetic nerve, oftentimes by two filaments.

290. Each trunk sends rami backward, to the vertebral and neighbouring muscles; and afterwards completes the formation of the nervus cruralis, together with the other portions of the lumbar nerves, already mentioned.

291. From the same place, it sends off a considerable branch, which joining a branch from the third pair, and one from the second, forms the nervus obturator.

292. Lastly, the remaining part of the trunk joins the fifth pair of lumbar nerves.

293. The obturator nerve, formed in the manner already described, runs along the inner lateral part of the psoas muscle, to the pelvis, and goes out of the abdomen, at the upper part of the obturator muscles, and foramen ovale of the Os Innominatum.

*Nervus obturator.*

294. As it goes out, it supplies the musculi obturatores and pectineus; and is afterwards distributed by three principal branches to all the portions of the triceps; and sends other rami between these portions, to the gracilis internus.

295. The fifth pair of lumbar nerves passes between the last vertebra of the loins and Os Sacrum; each trunk communicating above, with the fourth pair, and before, with the great sympathetic nerve. It sends rami backward to the vertebral and neighbouring muscles, and even to the glutæi; and as it bends forward, it sends a small ramus to the crural nerve.

*Fifth pair of lumbar nerves.*

296. Afterwards the trunk runs down on the symphysis of the Os Sacrum with the Os Ilium, enters the pelvis, and having received a communicating branch from the fourth lumbar pair, joins the nervi sacri, with which it forms a plexus, that produces the nervus sciaticus, the largest nerve of the human body, which is distributed to the lower extremity.

297. The nervi sacri are those that come from the Os Sacrum, the chief of which pass through the anterior holes of that bone, the rest through the lateral notches at the extremity of that bone, and in the Os Coccygis.

*Nervi sacri.*

298. These nerves are reckoned likewise by pairs, of which there are commonly six; four passing through the great

great anterior holes, and two below them. This number is increased, when there are five pairs of great holes; and some filaments pass likewise through the posterior holes.

299. The first pair is very large; all the rest diminish gradually, and the last is very small.

300. Those which pass through the great holes, unite together as soon as they enter the pelvis, and, together with the fifth lumbar pair, form the great plexus for the sciatic nerve already mentioned. They likewise send rami backward through the membranes of the posterior holes, to the neighbouring integuments.

301. The trunks thus united and interwoven with each other, give off other small branches, besides the great sciatic trunk; and it will be proper to describe the most considerable of these branches, together with the inferior nervi sacri, before we enter upon the detail of the ramifications of the great sciaticus.

302. This disposition resembles very much that of the last four cervical pairs and first dorsalis, which are not only interwoven together, to form the brachial nerves; but likewise send off many branches from their origin.

303. From this intertexture of the nervi sacri, especially from the second pair, a branch goes out to the vesiculæ feminales, prostate gland, uterus, tubæ Fallopiæ, &c. Another branch goes chiefly from the fourth pair, partly to the places just named, and partly to the bladder and intestinum rectum.

304. The same intertexture, and chiefly the third pair united in some subjects with the second, and in others with the fourth, and sometimes with both, produces a branch which goes out of the pelvis over the ligamentum Fallopii, passes on the inside of the tuberosity, and inner part of the Os Ischium, and is distributed to the corpus cavernosum, to the muscles thereof in both sexes, to the neighbouring parts of generation, and to the sphincters of the anus.

305. The last two pairs of nervi sacri are very small. That which goes out immediately below the great foramina, runs from behind forward, on each side, between the extremity of the Os Sacrum, and ligament of the Os Coccygis; being distributed chiefly to the muscles of the anus, and neighbouring integuments.

306. The

306. The next or last pair of nervi sacri runs down almost directly from the extremity of the canal of the Os Sacrum, and is likewise distributed to the anus, integuments, &c.

307. From the extremity of the plexus of all the nervi sacri, immediately before the formation of the great sciatic rope, a branch goes out to the glutæus medius and minimus. Another goes out posteriorly, which is distributed partly to the muscles of the corpus cavernosum, &c. and partly to the glutæus maximus, and neighbouring integuments, by several filaments, which reach as far as the ham.

308. The crural nerve, formed by the complicated union of the trunks of the first, second, and third pairs of lumbar nerves, and of a portion of the fourth, sometimes increased by a branch of the fifth pair, as has been already observed, passes under the ligamentum Fallopii, and goes out of the abdomen, on the outside of the crural artery, which lies between this nerve, and the crural vein.

309. As it goes out, it is divided into several branches, some of which are detached from its union with the ramus accessorius of the third pair, but the greatest number goes out from the trunk itself.

310. The branches which go from its union with the nervus accessorius, run down on the foreside of the thigh; and having reached the middle of the musculus sartorius, they follow its course, and are spent on the integuments of the fore and inner parts of the knee.

311. The most anterior branch passes on the fascia lata, or aponeurosis cruralis, forming cutaneous nerves all the way to the knee.

312. The internal branch runs along the tendon of the sartorius, in the same manner, all the way to its insertion in the tibia, where they are spent on the integuments; and some of them go to the inner angle, and convex part of the foot.

313. Afterwards the crural rope divides into a great number of rami, which, in their course downward, are distributed to the anterior muscles, viz. to the rectus, vasti, and cruralis; giving rami, in their passage, to the triceps, sartorius, gracilis internus, and semi-tendinosus.

314. It



314. It likewise gives off a branch, which runs down inferiorly between the sartorius and triceps, in the same course with the crural vessels, as far as the middle of the thigh.

315. Afterwards it runs near the integuments, behind the sartorius, to which it gives several filaments; and continues this course all the way to the insertion of that muscle.

316. Having reached the tibia, it lies near the vena saphena, and follows the same course with it, as far as the inner angle, where it detaches a great number of cutaneous filaments.

317. Lastly, it ends by ramifications, on the inner and upper part of the foot; where one of the most anterior ramifications adheres very closely to the saphena.

318. The great sciatic nerve being formed, as has been already said; or as it sometimes happens, from the last two pairs of the lumbares, and first three pairs of the sacri, runs obliquely backward, under the great sinus of the Os Ilium, and under the musculus pyriformis.

*Nervus  
sciaticus.*

319. It goes this way, out of the pelvis, passing between the pyriformis, and superior gemellus; and then running on the fore-side of the first of these muscles, and presently afterwards behind the two gemelli and quadratus femoris, it gives filaments to each of them.

320. It runs down in the next place, between the tuberculum ischii, and the great trochanter, along the inner and posterior part of the thigh, between the musculus biceps and semi-nervosus, as far as the hollow of the poples, a little nearer to the internal condyle than to the external, giving rami in its passage to all these muscles, and to the triceps, and diminishing gradually in size as it descends.

321. As it goes out of the pelvis, it gives out a branch, which passes between the portions of the ligamentum sciaticum, to the anus, perinæum, parts of generation, &c. and this branch joins a ramus from the third part of the nervi sacri, which goes to the same parts, as has been observed.

322. As it passes between the tuberosity of the ischium and the great trochanter, it produces two rami, one of which is spent on the glutæus maximus, the other divides into two, for the other two glutæi.

323. Below the great trochanter, where it may be termed *nervus sciatico cruralis*, it sends back a ramus, which runs

down with the sciatic vein, and is distributed to the integuments as low as the middle of the calf of the leg; and sometimes lower toward the outer angle.

324. The sciatic nerve having reached the ham, is commonly called *nervus popliteus*, and begins to be divided into two branches, which run at first very close to each other between the extremities of the biceps and semi-nervosus; and afterwards separate gradually, passing behind the condyles of the Os Femoris, between the superior extremities of the gastrocnemii.

325. The innermost of these two branches is very large, the outermost not so large. They are distributed to the whole leg, and, through this course, they may be termed *nervi sciatico-tibiales*.

326. The large branch of the sciatico-cruralis or cruralis internus, which may likewise be termed *popliteus internus*, runs down behind the musculus popliteus, on one side of the tibialis gracilis, commonly called *plantaris*, and between the two gastrocnemii.

327. Afterwards it pierces the upper extremity of the soleus, and runs down between this muscle and the great flexors of the toes, to the lower extremity of the tibia, near the inner angle.

328. In its passage, it sends small rami to the joint of the knee, to the gastrocnemius internus, to the other muscles last mentioned, and to the integuments, all the way down.

329. Besides these small rami, it sends off another more considerable branch towards its upper part, from which, one filament goes to the tibialis posticus, another perforates the interosseous ligament, and is distributed to the upper part of the tibialis anticus.

330. Soon after this, it detaches externally a long ramus, which runs down on the backside of the leg, between the integuments and external gastrocnemius, on one side of the vena sciatica or saphena externa.

331. This long ramus joins a branch of the sciaticus externus minor, sends off filaments toward each side, through its whole course, and having supplied the tendo Achillis, passes behind and under the outer angle.

332. This ramus passes afterwards on the outside of the foot, where it is distributed to the integuments, and neighbouring

bouring muscles, and terminates on both sides of the little toe, and on the outside of the toe next to that.

333. The large sciatic branch or sciatico-tibialis, having given off these different ramifications, passes behind the inner angle, through a particular annular ligament, and runs downward to the great lateral sinus of the Os Calcis, passing first between that bone and the musculus thenar, and then between it and the posterior insertion of the flexor digitorum brevis.

334. At this place, having first sent small filaments to the neighbouring parts, it divides into two rami, named *nervi plantares*, one internal and large, the other external.

335. The nervus plantaris internus is distributed to the foot, much in the same manner as the radial nerve to the hand. It runs first along the inside of the sole of the foot, and sends filaments to the thenar, flexor digitorum brevis, and to the musculus lumbricalium accessorius.

336. Afterwards it sends four branches to the lateral concave or lower parts of the first three toes, and to the nearest lateral part of the fourth toe. The first ramus goes to the inside of the great toe. The second divides into two, for the corresponding sides of the great toe and the second. The third, being bifurcated in the same manner, goes to the second and third toes; and the fourth to the third and fourth toes.

337. These nerves communicate on each side at the extremities of the toes, and, in their passage, give filaments to the muscoli lumbricales, interossei, and neighbouring ligaments and integuments.

338. The external plantaris passes between the musculus lumbricalium accessorius, and the flexor digitorum brevis, giving filaments to these muscles, to the interossei, and to the hypothenar minimi digiti; and afterwards it divides into two branches.

339. The first branch runs in the interstice between the last two toes, and being divided, goes to the corresponding lateral parts of both. The other branch goes to the inferior external lateral part of the little toe.

340. During this course, the external nervus plantaris supplies the aponeurosis plantaris, and the ligaments and integuments in the same manner as the rest.

341. The small sciatic ramus or *sciaticus externus*, called likewise *sciatico-peronæus*, runs outward over the head of the fibula; and is divided into several rami, among which there are three or four considerable, one posterior, one superior and anterior, one internal and anterior, and one external and anterior.

342. The posterior ramus runs down between the integuments and the fibula, as low as the outer angle, and terminates in the outside of the foot; having detached several cutaneous filaments in its passage.

343. About the middle of the fibula, it sends out a small ramus, which joins another ramus from the large or tibial ramus of the sciatic nerve, and is distributed together with it in the manner already said.

344. The posterior ramus of the small sciatic branch, having reached the outer angle, runs up a little way on the foot, towards the root of the fourth toe, where it divides into two smaller rami.

345. One of these rami divides into two others, for the corresponding lateral parts of the third and fourth toes; the other goes to the external lateral part of the fourth toe, where it joins a ramus of the external nervus plantaris, which is distributed to the last two toes.

346. After having sent off the posterior ramus, the small sciatic branch runs outward over the head of the fibula; and having given some filaments to the *gastrocnemii* and *soleus*, it runs across the upper extremity of the *peronæus posticus* from behind forward.

347. Afterward it passes between the bone and the muscle last named, and sends several filaments forward to the neighbouring parts, and then produces the three or four rami already mentioned, which are distributed in the following manner.

348. The superior and anterior ramus runs a little transversely between the head of the fibula and the upper extremity of the *extensor digitorum longus*; and having given filaments to this muscle, and to the *extensor pollicis longus*, it is distributed to the upper extremity of the *tibialis anticus*, giving filaments to the neighbouring integuments.

349. The inner anterior ramus runs down on the fore-side  
of



of the interosseous ligament, between the extensor pollicis longus and tibialis anticus, giving filaments to each of these muscles.

350. It passes afterwards under the annular ligament of the extensor muscles, behind the extensor pollicis, to the upper part of the foot, under the extensor digitorum brevis. In its passage, it gives filaments to that muscle, and to the first superior interossei.

351. Having communicated by a filament with the external anterior ramus, it is spent on the corresponding lateral parts of the first two toes.

352. The external anterior ramus of the small sciatic branch, runs down betwixt the fibula and the peronæus longus, and then between the peronæus medius, and extensor digitorum longus; to which, and to the neighbouring ligaments, it gives filaments all the way to the upper side of the foot.

353. In this course, having run along about two third parts of the leg, and having reached the great annular ligament, it runs forward and toward the integuments, being there divided into two portions, one of which goes to the great toe, the other to the last toes.

354. The first portion of this ramus gives a nerve to the internal lateral part of the great toe, and is afterwards distributed to the neighbouring integuments on the convex side of the foot, and lastly to the corresponding lateral parts of the great and second toes.

355. The other portion which goes to the last toes, is first of all joined to a filament of the first portion, and afterwards to another from the internal anterior ramus.

356. After this union, they are presently divided, and distributed to the last two toes, and to the integuments. One filament arising from this union, joins a ramus belonging to the great sciatic branch.

357. It is the common opinion, that each of the great sympathetic nerves begins by a filament from the sixth pair belonging to the medulla oblongata, and by two filaments from the fifth pair; and that these filaments do at first compose a very small nerve which runs backward, to

*Nervi sympathetici  
maximi, vulgo intercostales.*

go out of the cranium through the bony canal of the apophysis petrosa, and increases gradually in its course downward.

358. But having examined attentively the pretended origin of these filaments, they seem to me rather to ascend from the basis of the cranium with the internal carotid, and to run from behind forward to join the fifth and sixth pairs; and I find the angle formed by this union to be turned forward, and withal so very acute, that these nerves cannot be looked upon as recurrents.

359. And as I have ever since that time, that is, for twenty years past, found this angle disposed the same way in all the subjects that I have dissected; I have always been of opinion, that what had been taken for the original root and descending stem of the nerve called *intercostalis*, was really an ascending branch thereof, which, as it enters the cranium, is divided into filaments, by which it becomes closely united with the two pairs already named.

360. The observation communicated to the royal academy by M. Petit, doctor of physic, concerning the different size of the portions of the sixth pair, appears to be indisputable; he having found this nerve larger on the fore-part, between the filament of the supposed intercostal and the orbit, than on the back-part between the same filament and the origin of the sixth pair: and his experiments concerning the real co-operation of this nerve in vision, are still a further confirmation of his observation.

361. These nerves, as I have said, are commonly called *intercostales*, though this name does not agree either with their situation, or with the extent of their course, as we shall presently see; and therefore I believe the name of *sympathetici majores* or *maximi*, will be more proper, because of their frequent communications with almost all the other principal nerves of the body.

362. The situation of these two nerves in general, is on the lateral parts of the whole twenty-four vertebræ, immediately before the roots of the transverse apophyses, and likewise on the lateral parts of the inside of the Os Sacrum.

363. Through this large extent, they appear like two ropes divided, and in a manner intersected at different distances, by a great number of gangliform tubercles, by means of which they

they communicate backward with the ganglions of the medulla spinalis, by short collateral filaments; and produce forward, all their particular ramifications.

364. These ganglions differ more or less from each other in size, colour, and consistence; and may be looked upon as so many origins or germina dispersed through this great pair of nerves, and consequently as so many little brains. I shall speak to them more particularly, in the description of the head; and it will be sufficient in this place to pursue their distributions, and the course of their ramifications.

365. For this purpose, we need only consider these ganglions, in the same manner that we did the vertebral nerves, as divided into cervicalia, dorsalia, lumbaria, and sacra, without pretending to determine the number contained in each class.

366. The first cervical ganglion is the most considerable in size, but not in consistence, representing a soft oblong tumour of the figure of an olive, and situated longitudinally before the root of the transverse apophyses of the first three vertebræ, immediately behind the pharynx.

367. It produces from its superior extremity a small soft nerve, which runs up with the internal carotid artery of the same side, into the bony canal of the apophysis petrosa.

368. At its entry into this canal, it is divided into several plexiform filaments, which at that place surround the carotid artery, and accompany all the incurvations thereof, till it enters the cranium. They adhere very closely to the artery, and both they and their trunks are very tender, having oftentimes neither the colour nor consistence of nervous filaments; for they are reddish, and sometimes in a manner mucilaginous. We must not mistake for these plexiform filaments, some lacerated portions of the dura mater, which line this bony canal.

369. Among these filaments, there are two or three principal ones, which appear to be only a simple division of the trunk, and which, as they enter the cranium, unite again into a small trunk, more solid than the former. The small superior trunk is immediately afterwards divided into filaments, one of which is united to the nerve of the sixth pair, the rest join the fifth pair, as has been already said. The filament which goes to the sixth pair is commonly single, but I have

have sometimes found it double, or divided all the way to the union.

370. Immediately below the inferior orifice of the bony canal of the apophysis petrosa, and from thence all the way down to the occipital condyle on the same side, or to the top of the first ganglion, the small ascending trunk is a little stronger, and not altogether so soft as it is in the canal.

371. The first cervical ganglion is of a middle consistence, and adheres very closely to the trunk of the eighth pair, or nervus sympatheticus medius, by numerous small communicating filaments.

372. It likewise communicates on both sides, by short branches, with the ninth and tenth pairs of nerves of the medulla oblongata; with the first, second, and sometimes the third cervical pairs; and also with that branch which the eighth pair sends to the pharynx.

373. In its passage, it gives filaments to the pharynx, to the small neighbouring muscles, and to the carotid artery, from which it receives very fine capillary vessels, which are plainly visible in inflammations; and seem to form a curious network, with the nervous filaments.

374. Lastly, it sends downward a very long nervous filament, which runs in the thorax, and joins other filaments, of which hereafter.

375. This ganglion terminates below, in a small rope or trunk, which runs down on the anterior vertebral muscles of the neck, in the same course with the eighth pair, and the carotid artery of the same side; to both which it is connected by membranous expansions, as by a kind of vagina, all the way to the last vertebra of the neck.

376. In this course, the descending trunk communicates on the outer or backside with the third, fourth, fifth, and often with the sixth cervical pairs, by short branches, more or less oblique, by which it seems to be gradually increased in size.

377. At the places of these communications, we observe small ganglions, in this trunk, which however, in some subjects, are scarcely perceptible; and it is very difficult to determine, by which extremity these branches arise, and by which they are inserted.

378. On the inner or foreside, this trunk gives off two or three



three filaments, which run obliquely downward, toward the aspera arteria, into the thorax; another filament goes off, below the first cervical ganglion, which passes on the foreside of the carotid artery, and joins a filament of the eighth pair, with which it forms a small distinct rope.

379. This small rope runs before the subclavian vein, and lower down joins another filament, which arises behind the subclavian artery, and runs down in the manner hereafter to be explained, sending off filaments in its passage to the œsophagus, and neighbouring parts.

380. The trunk having reached as far as the last vertebra of the neck, forms a small ganglion, called *ganglion cervicale infimum*, which is pretty solid, and sometimes double.

381. Presently afterwards, the trunk turns from within outward, towards the root of the first rib, behind the subclavian artery, where it forms a pretty large ganglion, which is the first of the thoracica or dorsalia.

382. These two last mentioned ganglions are very near each other, being separated only by a very short portion of the trunk, which is sometimes double, and forms a kind of small plexus behind the subclavian artery.

383. From the fore-part of the lowest cervical ganglion, a small nervous rope goes out, which runs before the subclavian artery, bends immediately downward, and ends in the top of the first dorsal ganglion, forming by this course a sort of nervous arch, which incloses the subclavian artery.

384. These two ganglions communicate, by short branches more or less oblique, with the neighbouring vertebral nerves, that is, with the sixth and seventh cervical pairs; and sometimes with the fourth, by a long descending filament. The first dorsal ganglion communicates likewise with the first dorsal pair of nerves.

385. The lowest cervical and sometimes the first dorsal ganglion, sends down a communicating filament to the recurrent nerve of the eighth pair; and from this union a filament is detached, which passes behind the common trunk of the axillary and carotid arteries, joins another filament from the eighth pair, and contributes to the formation of the plexus pulmonaris.

386. From the small plexiform portion of the trunk which joins the last cervical and first dorsal ganglions, behind the

subclavian artery, a particular filament goes out, which unites with the small trunk common to the great sympathetic, and to the eighth pair, and runs down before the subclavian artery, and together with this filament composes the plexus cardiacus.

387. On the right side, this filament runs down to the right ventricle of the heart, and then between the aorta and arteria pulmonaris, where it communicates with some filaments from the left recurrent of the eighth pair.

388. On the left side, a filament goes out from the last cervical, and another from the first dorsal, or thoracic ganglion, which unite together to form a kind of arch, in which, however, nothing is contained.

389. From this arch a nerve goes out, which runs down between the curvature of the aorta, and the left branch of the pulmonary artery, where it communicates with a filament of the eighth pair, and forms a gangliform plexus, with the like communicating and united filaments from the right side.

390. From this gangliform plexus, which may be looked upon as the origin of the plexus cardiacus superior, a great number of filaments run down, over the trunks of the great blood-vessels, and over the auricles and ventricles of the heart.

391. The chief of these filaments run in the cellular substance behind the aorta, or between that and the trunk of the pulmonary artery, where they are divided into a great many small nerves, which run before and behind the aorta, to the basis and auricles of the heart.

392. The filaments that run down from the trunk itself, between the first and last cervical ganglions, are united and interwoven in the thorax, with the filaments common to the last cervical and first dorsal ganglions, thus contribute to the formation of the plexus cardiacus, and some part of the plexus pulmonaris.

393. The long filament of the first cervical ganglion contributes likewise to these plexus. It runs along the inside of the trunk, and then unites with the filaments of the last cervical ganglion, the first dorsal ganglion, and the great recurrent nerve.

394. From all these conjunctions a particular nerve is formed in some subjects, which meets a like rope from the other side

side behind the aorta; and forms, together with that, a kind of subordinate trunk, about a finger's breadth in length, which sends out on all sides several filaments that are distributed to the neighbouring parts.

395. From the first dorsal ganglion, the trunk runs down on the fore side of the heads and necks of all the ribs, over the articular ligaments by which they are tied to the vertebræ. On the last false rib, it bends a little toward the bodies of the vertebræ.

396. In this course, the trunk forms a small ganglion, between each rib, and communicates backward, by two short filaments more or less oblique, with the corresponding dorsal or costal nerves.

397. Of these two communicating filaments, one is more oblique and often smaller than the other; one runs backward, towards the nearest ganglion of the costal nerve, the other runs forward on the head of the rib, to the trunk of the great sympathetic nerve; and for this reason, one of these filaments appears to be more anterior and longer than the others.

398. Having reached about half-way between its entry into the thorax and the last vertebra of the back, this trunk sends commonly five branches, obliquely downward on the lateral, and a little toward the anterior part of the bodies of the vertebræ.

399. The first four branches come commonly from the fifth, sixth, seventh, and eighth thoracic ganglions, and the fifth arises from several of the following ganglions. The first is the longest, and the last is the thickest.

400. All these branches approach each other gradually in their descent as far as the last vertebra of the back, where they unite into one large short collateral rope, which pierces the upper lateral part of the lower muscle of the diaphragm, sending some filaments to the upper side.

401. Having got below the diaphragm, and given off some filaments to the lower side of that muscle, this great trunk produces behind the glandula renalis, a kind of irregular ganglion of a curve oblong figure, called *ganglion sive plexus semilunaris*.

402. The convex side of this semilunar plexus or ganglion, is turned obliquely backward and downward, the concave

cave side forward and upward, one of its coruna being turned upward, the other forward; so that the inferior cornua of the two ganglions on each side, are turned toward each other.

403. These ganglions on each side communicate together, behind the stomach, on the cæliac artery, and likewise with the eighth pair or nervus sympatheticus medius, chiefly by means of the nervus stomachicus posterior belonging to that pair.

404. From the reciprocal communication of these two semilunar ganglions, a kind of middle plexus is formed, which partly surrounds the cæliac artery, and is partly spent on the mesocolon.

405. The semilunar ganglion on the right side, together with a large portion of the plexus cæliacus, and some filaments of the plexus stomachicus, form a particular intertexture, called *plexus hepaticus*.

406. This hepatic plexus having communicated with some filaments of the diaphragmatic nerve, produces several filaments which surround the hepatic artery and vena portæ in form of a reticular vagina, and accompany the branches of these vessels through the whole substance of the liver. The hepatic plexus supplies likewise the vesicula fellis, ductus biliarii, duodenum, pancreas, and glandulæ renales.

407. The left semilunar ganglion, formed by the anterior or collateral trunk of the left side, produces several rami, which form the plexus splenicus, nearly in the same manner as has been already mentioned.

408. This plexus splenicus, having communicated with the hepaticus, and by the intervention of the plexus stomachicus, with the eighth pair, surrounds the splenic artery, supplies the pancreas, and is distributed to the spleen.

409. This left ganglion is sometimes accompanied by another, which gives filaments to the spleen.

410. Each semilunar ganglion sends rami from its convex side, which being joined to the filaments of the first lumbar ganglions, form an intertexture called *plexus renalis*, which surrounds the renal artery, is distributed to the kidneys, and glandulæ renales, and sends out a filament, which accompanies the spermatic vessels.

411. This renal plexus concurs likewise with the semilunar ganglion in the formation of the great mesenteric plexus  
and



and communicates by several filaments with the *plexus coronarius stomachicus*.

412. The right renal plexus communicates particularly with the *plexus hepaticus*; and the left, with the *splanicus*; and each of them, by two filaments, with the true trunk, on the side of the first two vertebræ of the loins. This portion of the principal trunk is commonly called the *inferior rope* of the intercostal nerve.

413. The right and left semilunar ganglions send nervous fasciculi to each other, which by a particular intertexture form a kind of flat ganglion or plexus, immediately under the diaphragm, before the articulation of the last vertebra of the back with the first of the loins.

414. From this plexiform union, called commonly *plexus solaris*, several filaments are detached in a radiated manner to the mesocolon and mesentery; and some of them go likewise to the diaphragm.

415. A great number of other filaments go likewise from it, which, with the ramifications thereof, form a kind of nervous capsula or vagina, round the superior mesenteric artery, and round all its ramifications on the intestines, and supply the mesenteric glands. This is termed *plexus mesentericus superior*, which comes chiefly from the filaments of the *plexus hepaticus* and *renalis*, and of the right semilunar ganglion.

416. The superior mesenteric plexus sends down from its origin, along the aorta, and behind the descending portion of the mesocolon, between the superior and inferior mesenteric arteries, several filaments or nervous fasciculi differently interwoven, from which a nervous vagina is likewise formed, that surrounds the inferior mesenteric artery, and its ramifications on the intestines. This has been named *plexus mesentericus inferior*.

417. The descending nervous fasciculi, between the two mesenteric arteries, which may be named *mesenterici posteriores*, receive some communicating filaments from both *plexus renales*, and likewise communicate with the trunk of the great sympathetic nerve, by filaments which run down obliquely from the lumbar ganglions. Afterwards they detach a filament on each side, which accompanies the spermatic vessels.

418. The fasciculi *mesenterici posteriores* having produced

ced the plexus mesentericus inferior, send other filaments downward, over the extremities of the aorta, behind the inferior curvature of the colon.

419. These inferior fasciculi or filaments adhere strongly to the neighbouring parts of the peritonæum, and, together with other filaments from both sides of the trunk, form a third plexus, which may be called *infra-mesentericus*, or *hypogastricus*.

420. This hypogastric plexus, at the extremity of the last curvature of the colon on the fore-side of the last vertebra of the loins, is divided into two flat ganglions which surround the beginning of the intestinum rectum backward, to which they are afterwards distributed, and also to the bladder and to the spermatic vessels; and having communicated, by lateral filaments, with each trunk of the great sympathetic nerve, they send filaments to all the parts contained in the pelvis.

421. The trunk of the great sympathetic nerve having detached the five rami which form the collateral rope, becomes much smaller, and having reached the eleventh vertebra of the back, it approaches the collateral trunk, and perforates the inferior muscle of the diaphragm.

422. Afterwards it runs more forward on the bodies of the vertebræ, and increases by the addition of filaments from the last two dorsal pairs of nerves.

423. It runs down between the psoas and neighbouring tendons of the small muscle of the diaphragm, on the lateral parts of the vertebræ lumbares and anterior side of the Os Sacrum.

424. At this place the right and left sympathetic trunks approach each other, and at the extremity of the Os Sacrum, they form a communication in the manner of an inverted arch.

425. In its passage, each trunk receives commonly two filaments from each ganglion of the nervi-lumbares and sacri, and likewise forms small ganglions between each vertebra, which send some filaments to the neighbouring parts, and others which communicate with the fasciculi of the plexus mesenterici.

426. The pairs of filaments which come from the two or three first lumbar ganglions, run a little downward, but the following

following run gradually upward; and it ought to be observed that capillary blood-vessels are discernible between and upon the filaments of each pair.

427. The inverted arch or inferior union of the two trunks, gives off together with the two lowest nervi sacri, several filaments to the rectum, anus, and muscles of the coccyx.

428. Lastly, the great sympathetic nerve, from the first vertebra of the neck to the extremity of the Os Sacrum, communicates, by filaments, with all the vertebral nerves, as has been already said; but it must be observed, that, in the thorax, these communicating filaments are very small and slender, where the sympathetic trunk is largest; and that below the diaphragm, they are stronger, because there the trunk diminishes, especially on the Os Sacrum, where it is very small. The same thing is to be observed concerning the ganglions of the trunk, the first cervical ganglion only excepted.

## S E C T. VII.

*A compendious view of the parts of the human body, and a description of the common integuments.*

### A R T. I.

*A view of the parts of the human body.*

1. **T**HE human body is composed of firm and liquid parts, commonly called *solids and fluids*. *Introduction.* Of the solid parts some are hard, others soft and flexible.

2. The solid parts are the chief subject of anatomy properly so called; by which term, borrowed from the Greek, we understand not only an artful decomposition of the parts of the body, but also a methodical demonstration and description of the parts when taken to pieces.

3. The history of the fluid parts comes into a system of anatomy,

anatomy, only occasionally, and by the by; because it properly belongs to what is called *physiology*, or the *animal economy*.

4. Anatomists ordinarily reduce all the solid parts under certain general classes, expressed by the common or generical names of *bone*, *cartilage*, *ligament*, *fibre*, *membrane*, *vessel*, *artery*, *vein*, *nerve*, *muscle*, *gland*, *fat*, *viscus*, *organ*, &c.

5. The ancients who settled a general division of the parts of the human body, from the mere outward appearance of their structure, called some *similar* or *simple*, and the rest *organical* or *compound*; but I look on these terms only as so many anatomical words, which express several parts that have nearly the same structure to outward appearance; and as they are often mentioned, I shall here give an explication of those which are in most frequent use.

6. By bones, we mean in general the hardest, most solid, and most inflexible parts of the human body, the particular history of which is contained in the description which I have given of the dry and fresh bones.

*Explication of the  
general terms of  
anatomy.*

7. A cartilage is a whitish or pearl-coloured substance, softer than a bone, but harder than any other part, smooth, polished, pliable, and elastic. I explained the cartilages in the description of the fresh bones.

8. A ligament is a white, fibrous, compact substance, more pliable than a cartilage, difficult to be broken or to be torn, and yielding but a very little when drawn out with force. The ligaments have been explained at full length in the second section.

9. The name of *fibre* is given to small filaments which appear to be the most simple parts of the body, and which, by their different disposition and connections, compose all the other parts. The fibres themselves differ in substance, being either membranous, fleshy, tendinous, or bony; in direction, being either straight, oblique, longitudinal, transverse, circular, or spiral; and in size, being either large, small, long, or short.

10. By membrane we understand a pliable texture of fibres disposed or interwoven together in the same plane. They differ in thickness according to the smallness of their fibres and number of their planes. These particular planes  
are



are termed *laminae*; and distinguished into external, internal, middle, &c.

11. The difference of membranes in general depends on that of the fibres, of which they are composed. Small portions of membranes, especially when they are very thin, are called *pelliculae*; and some membranous *laminae* are united together by the intervention of a particular substance, composed of this sort of pellicles, and called *the cellular or spongy substance*.

12. Vessels are tubes, ducts, or canals, more or less flexible, composed of different membranes, the strata of which are generally termed *tunicae* or *coats*. Some of them are divided into branches, and these again into rami and ramifications, which gradually diminish, but still remain hollow.

13. The general design of the vessels is to contain fluids, from the diversity of which they are distinguished into blood-vessels, *vasa lactea*, *lymphatica*, &c. The last and smallest extremities of all sorts of vessels are generally termed *capillaries*.

14. The blood-vessels are of two kinds, one of which receives the blood from the heart, and distributes it to all the parts of the body, which are named *arteries*; the other brings the blood from all the parts, back to the heart, which are called *veins*, and some of these have the name of *sinusses*.

15. The arteries are thicker than the veins, and may be distinguished by this mark in dead bodies; and in living bodies they are known by a certain beating called the *pulse*. The veins lie nearer the surface of the body than the arteries, and are furnished with valves, that is, with small membranous sacculi, fixed at different distances to the sides of their cavities. The openings of these valves are broad, and turned toward that side where the vein is largest, but their bottoms are turned the contrary way to that side where the veins are of the smallest diameter. In some places these valves are single, in others double, triple, &c.

16. By nerves, anatomists mean the white ropes which proceed from the cerebrum, cerebellum, and spinal marrow, and are spread over all the parts of the body by filaments and ramifications.

17. Each nervous roup may be looked upon as a membranous

nous vessel, the cavity of which is filled by a great number of membranous longitudinal septa, and by medullary filaments which lie betwixt the septa.

18. Muscles are bundles of fibres, called by anatomists *fibræ motrices*, of a reddish colour, and of different lengths.

19. The middle portion of the moving fibres is the principal, and differs from the extremities in being red, thick, soft, and capable of contraction, whereas the extremities are white, small, compact, and incapable of yielding.

20. This middle portion of each moving fibre is said to be fleshy, and they form what is properly called flesh. The extremities are called *tendinous*, and the substance formed by them, *tendons*.

21. Glands are clusters or molecularæ, distinguishable from all the other parts of the body, by their form, consistence, texture, and connection.

22. They are in general made up of arteries, veins, nerves, and other particular vessels, and of a substance which unites all these together, in their different folds, contortions, and inter-textures, all invested by a membranous covering.

23. The office of glands is to separate from the mass of blood, by means of certain secretory vessels, fluids which they discharge either immediately or by other vessels termed *excretory*; and these fluids are either accumulated in particular reservoirs, collected in the common cavities, or forced out of the body.

24. Fat and marrow are equivocal terms. By the first we generally understand an oily, soft, white, or yellowish substance, of different consistences, collected between the skin and the muscles, in the interstices of the muscles, about the viscera, &c. and composed partly of a cellulous or spongy substance, and partly of an oily matter of different thickesses. This oily matter is called *fat*, especially when separated from the cellulous substance, and likewise *corpus adiposum* by anatomists.

25. Marrow is one kind of fat, and differs from it only in the fineness of the membranous texture, in the subtility of the oily matter, and its situation within the bones. The word *marrow* is equivocal in the same sense, with the word *fat*.

26. By viscera, we commonly understand parts contained in a great cavity without being connected to it through their whole

whole extent or circumference. Such are the stomach, intestines, &c. in the abdomen, and the lungs in the thorax.

27. Organ or instrument is a term given to every part capable of any function, whether it be simple or complex, and in this sense we talk of the organ of sight, of respiration, &c.

28. The human body is commonly divided into the head, trunk, and extremities. The trunk is again subdivided into the neck, thorax, and abdomen; and the extremities into superior, called the *arms*, and inferior, called the *legs*.

*General division of the human body.*

29. The ancients divided the body into three great cavities, which they termed *venters*, and into four extremities. They called the head the *upper venter*, the thorax the *middle venter*, and the abdomen the *lower venter*. The neck was by some joined to the head; by others, to the thorax.

30. The most natural and plainest division of the body, is into the head, neck, thorax, abdomen, arms, and legs; each of which portions may afterwards be subdivided.

31. Each portion is to be examined not only with regard to its surface or external conformation, but also with regard to its internal structure or composition, and to the viscera and organs which it contains or supports.

32. This is what gave occasion to the ancients to divide the body into parts containing, and parts contained; and to subdivide the containing parts into common and proper. The common containing parts have been named *integuments*, by which they mean chiefly the skin and fat.

33. The head viewed on the outside is divided into the hairy scalp and face.

*External parts of the head.*

34. The hairy scalp covers the upper part of the *Os Frontis*, the *Ossa Parietalia*, the *Os Occipitis*, and the upper and lower portions of the *Ossa Temporum*.

35. The uppermost part of the hairy scalp is termed the *vertex* or *fontanella*; the back part, *occiput*; the lateral parts, the *temples*. The vertex is distinguished from the occiput, by a contorted border of hair; and the temples, by the ears.

36. The arteries on each side of the hairy scalp, are these: *Arteria carotis externa*, in general *arteria temporalis*. *Arteria occipitalis*. *Arteria angularis*, by communication. *Ar-*



teria cervicalis posterior, by communication. Arteria vertebralis, by communication. Arteria carotis interna, by communication.

37. The veins on each side of the hairy scalp, are these: Vena jugularis externa, in general. Vena jugularis externa posterior. Vena temporalis. Vena occipitalis. Vena vertebralis. Vena jugularis externa anterior, by communication. Vena jugularis interna, by communication. Sinus lateralis duræ matris, by communication. Vena axillaris, by communication. Vena cephalica, by communication.

38. The nerves on each side of the hairy scalp, are these: Nervi suboccipitales, commonly called the tenth pair from the medulla oblongata. Par nonum from the medulla oblongata. Par primum cervicale. Par secundum cervicale, by communication. Nervi diaphragmatici, by communication. Ramus frontalis of the orbitary or ophthalmic nerve. Nervus sympatheticus minor, called the *portio dura* of the auditory nerve. Nervus sympatheticus medius, or nerves of the eighth pair from the medulla oblongata, by communication. Nervus sympatheticus maximus, commonly termed *intercostalis*, by communication.

39. The face comprehends all that portion of the surface of the head, which lies between the hairy scalp, and the neck, *viz.* the forehead, eyebrows, palpebræ, eyes, nose, mouth, chin, cheeks, and ears.

40. The external parts of the eye are these: The anterior portion of the globe of the eye, the membrana conjunctiva, the cornea, lucida, iris, pupilla, caruncula, lachrymalis, angles of the palpebræ, and the cilia, or hairs of each palpebra. The internal parts are: The globe of the eye, the tunica sclerotica or cornea opaca, the choroides, arachnoides, chrySTALLINE, vitrious humour, aqueous humour, the anterior and posterior chambers, the muscles, and the optic nerve.

41. The external parts of the ear, are these: The great concha, the convex side of this concha, or hinder part of the ear, the great border, the fold or helix, the concavity, the broad eminence or anthelix, the small anterior eminence, or tragus, the small posterior eminence, or antitragus, the lobe or lower extremity of the ear, and the meatus.

42. The external parts of the nose, are these: The upper extremity or root of the nose, the arch or back, the sides  
of



of that arch, the tip of the nose, the alæ, the nares, and the septum narium. The internal parts are the cavity and bottom of the nares, the convolutions, the maxillary, sphenoidal, and frontal sinusses.

43. The external parts of the mouth, are these: The lips, one upper, the other lower, the angles or commissures of the lips, the border or edge of each lip, the fossula which runs from the septum narium to the edge of the upper lip, and the transverse fold which separates the under lip from the chin.

44. The internal parts of the mouth, are these: The palate, the septum palati, the uvula, the amygdalæ, gums, fræna of the lips, the tongue, its apex, roots, sides, and frænum. The other internal parts of the mouth, eye, nose, and ear, such as the glands, membranes, muscles, &c. must be referred to the particular descriptions of these parts.

45. The cheeks are the lateral parts of the face, reaching downward from the eyes and temples, between the nose and ears. The upper prominent part of the cheek is commonly termed *mala*.

46. The chin is the anterior protuberance, by which the lower part of the face is terminated, from whence it runs all the way to the neck. This under part of the chin, is termed the *basis*, and it is distinguished from the throat, by a transverse fold, which reaches from ear to ear. In the middle of the chin, there is sometimes a fossula or depression.

47. The exterior arteries which belong to each side of the face, are these: Arteria carotis externa. Arteria carotis interna, by communication. Arteria vertebralis, by communication. Arteria cervicalis, by communication.

48. The exterior veins distributed to each side of the face, are these: Vena jugularis externa. Vena jugularis interna, by communication. Vena vertebralis, by communication.

49. The exterior nerves spread on each side of the face, are these: Nervus olfactorius. Nervus opticus. Nervus orbitarius sive ophthalmicus, which is the first branch of the fifth pair from the medulla oblongata. Nervus maxillaris superior. Nervus maxillaris inferior. Nervus trochlearis sive patheticus, which is the fourth pair. Nervus motor oculi externus, sive muscularis externus, which is the sixth pair. Nervus sympatheticus minimus, or the portio dura of the auditory

auditory nerve. Nervus sympatheticus medius, which is the eighth pair. Nervus sympatheticus maximus five universalis, commonly called *intercostalis*. Nervus hypoglossus major, which is the ninth pair. The second pair of the nervi cervicales.

50. The arteries of the forehead, are these: Arteria temporalis, which is a branch of the external carotid. Arteria angularis, which is a branch of the internal carotid. Arteria carotis interna, by communication.

51. The veins of the forehead, are these: Vena frontalis, formerly called *preparata*. Vena temporalis. Vena angularis. Sinus obitarius. Sinus longitudinalis superior, by communication. Sinus longitudinalis inferior, by communication. Vena jugularis interna, by communication.

52. The nerves of the forehead are these: Nervus orbitarius five ophthalmicus, which is the first branch of the fifth pair from the medulla oblongata. Nervus maxillaris superior. Nervus maxillaris inferior. Nervus sympatheticus minor, which is the portio dura of the nervus auditorius.

53. The arteries which go to the eye, are these: Arteria temporalis, which is a branch of the external carotid. Arteria maxillaris externa five angularis, which is a branch of the external carotid. Arteria maxillaris interna, which is a branch of the external carotid. Arteria carotis interna.

54. The veins which belong to the eye are these: Vena temporalis, which is a branch of the posterior external jugular. Vena angularis, which is a branch of the anterior external jugular. Vena frontalis, formerly named *preparata*, which is a branch of the anterior external jugular. Sinus obitarius. Sinus longitudinalis, by communication. Vena jugularis interna, by communication.

55. The nerves belonging to the eye, are these: Nervus olfactorius, by communication. Nervus opticus. Nervus motor communis, or the third pair. Nervus trochlearis, or the fourth pair. Nervus orbitarius five ophthalmicus, a branch of the fifth pair. Nervus maxillaris superior, a branch of the fifth pair. Nervus motor externus. Nervus sympatheticus minor, or the portio dura of the auditory nerve. Nervus sympatheticus maximus five universalis, commonly called *intercostalis*.

56. The arteries distributed to the nose, are these: The same

same arteries with those which go to the eye, among which the internal carotid supplies the nose, by communication. *Arteria labiorum orbicularis*, by communication.

57. The veins belonging to the nose, are these: All the veins already mentioned, as belonging to the eye.

58. The nerves which go to the nose, are these: *Nervi olfactorii*. *Nervus orbitarius sive ophthalmicus*, a branch of the fifth pair, both immediately and by communication. *Nervi motores communes*, or the third pair, by communication. *Nervi maxillares superiores*, branches of the sixth pair. *Nervus sympatheticus minimus*. *Nervus sympatheticus medius*, by communication.

59. The arteries which go to the ear, are these: *Arteria temporalis*, a branch of the external carotid. *Arteria auricularis*, a branch of the temporalis. *Arteria occipitalis*, by communication. *Arteria vertebralis*, by means of the *arteria basilaris*, which is a continuation of it. *Arteria carotis interna*, by communication with the *arteria basilaris*.

60. The veins belonging to the ear, are these: *Vena temporalis*. *Vena occipitalis*. *Vena cervicalis*. *Vena maxillaris*: these three being branches of the *jugularis externa*. *Vena jugularis interna*, by several communications. *Sinus petrosus duræ matris*.

61. The nerves distributed to the ear, are these: *Nervus maxillaris inferior*, the third branch of the fifth pair. *Nervus auditorius*, the seventh pair. *Nervus sympatheticus minimus*, the portio dura of the auditory nerve. *Nervus hypoglossus externus*, the ninth pair, by communication. *Nervus sub-occipitalis*, the tenth pair, by communication. The second cervical pair. *Nervus sympatheticus medius*, the eighth pair. *Nervus sympatheticus universalis*, commonly called *intercostalis*.

62. The arteries which go to the mouth, tongue, &c. are these: The artery of the chin. *Arteria coronaria sive orbicularis labiorum*, both being branches of the external carotid. *Arteria maxillaris interna*. *Arteria sub-lingualis*.

63. The veins belonging to the mouth, tongue, &c. are these: *Vena maxillaris externa*. *Vena maxillaris interna*. *Venæ raninæ*. All these are branches of the external jugular. *Vena jugularis interna*, by several communications. *Vena gutturalis*



turalis superior, a branch of the internal jugular. Vena axillaris, when it sends off the guttural vein.

64. The nerves distributed to the mouth, tongue, and salivary glands, &c. are these: Nervus maxillaris superior. Nervus maxillaris inferior, both branches of the fifth pair. Nervus sympatheticus minimus, or portio dura of the auditory nerve. Nervus sympatheticus medius, the eighth pair. The ninth pair from the medulla oblongata. The second pair of cervical nerves. Nervus sympatheticus maximus, by communication.

65. The cheeks on each side are furnished with arteries and veins from the nearest ramifications of the temporal and maxillary arteries and veins; and with nerves from the portio dura of the auditory nerve, and from the superior and inferior maxillary nerves.

66. The neck in general is divided into the anterior part or throat, and posterior part or nape. The throat begins by an eminence, and terminates by a fossula. The nape begins by a fossula, which, as it descends, is gradually lost. The neck contains the larynx, a part of the trachea arteria, the pharynx, a part of the œsophagus, the musculi cutanei, sterno-mastoidæi, sterno-hyoidæi, thyro-hyoidæi, omo-hyoidæi, splenius complexus, the musculi vertebrales, which lie upon the first seven vertebræ, and a portion of the medulla spinalis.

67. The arteries which go to the neck, are these: Arteriæ carotides in general. Arteriæ carotides externæ. Arteriæ carotides internæ. Arteriæ vertebrales. Arteriæ cervicales.

68. The veins belonging to the neck, are these: Venæ jugulares in general. Venæ jugulares externæ. Venæ jugulares internæ. Venæ cervicales. Venæ vertebrales.

69. The nerves distributed to the neck, are these: Nervi sympathetici minimi, or the portio dura of the auditory nerves. Nervi sympathetici medii, the eighth pair. Nervi accessorii octavi paris. The ninth pair. Nervi sub-occipitales, or the tenth pair. The seventh cervical pair. Nervi sympathetici maximi.

*Parts of the  
thorax.*

70. By the thorax, we commonly understand all that part of the body, which answers to the extent of the sternum, ribs, and vertebræ of the back, both outwardly and inwardly.

71. The



71. The thorax is divided into the anterior part, called commonly the *breast*, the posterior part called the *back*, and the lateral parts called the *right* and *left sides*.

72. The external parts of the thorax, besides the skin and membrana adiposa, are principally the mammæ, and the muscles which cover the ribs, and fill the spaces between them. In the mammæ we see the papillæ or nipples, and a small coloured circle, which surrounds them. The muscles are the pectorales majores and minores, subclavii, ferrati majores, ferrati superiores postici, latissimi dorsi, and vertebrales, and to these we may add the muscles which cover the scapula.

73. The internal parts of the thorax are contained in the large cavity of that portion of the trunk, which the ancients called the *middle venter*; but the moderns name it simply, *the cavity of the breast*. This cavity is lined by a membrane named *pleura*, and divided into two lateral cavities, by a membranous septum named *mediastinum*, which is a production or duplicature of the pleura.

74. These parts are the heart, pericardium, trunk of the aorta, great arch of the aorta, trunks of the carotid arteries, subclavian arteries, trunks of the vertebral and axillary arteries, the superior portion of the descending aorta, the intercostal arteries, the vena cava superior, vena azygos, subclavian veins, trunks of the jugular, vertebral and axillary veins, a portion of the aspera arteria, and of the œsophagus; the ductus lacteus, or thoracicus, the lungs, pulmonary artery, pulmonary veins, &c.

75. The arteries and veins which particularly belong to the thorax, are these: Arteriæ & venæ thoracicæ, superiores & inferiores. Arteriæ & venæ mammariæ, internæ & externæ. Arteriæ & venæ intercostales, superiores et inferiores. Arteriæ & venæ spinales, with the venal sinuses of the canal of the spine.

76. The nerves distributed to the thorax, are these: Nervi sympathetici medii, or the eighth pair. Nervi sympathetici universales, commonly called *intercostales*. The last cervical pair. The twelve dorsal pairs. Nervi diaphragmatici.

77. The cavity of the thorax is terminated downward, by the diaphragm which parts it from the abdomen.

78. The abdomen begins immediately under the thorax,

*Parts of the  
abdomen.*

and terminates at the bottom of the pelvis of the *Offa Innominata*. Its circumference or outer surface is divided into regions, of which there are three anterior, viz. the epigastric or superior region, the umbilical or middle region, and the hypogastric or lower region. There is but one posterior region, named *regio lumbaris*.

79. The epigastric region begins immediately under the appendix eniformis at a small superficial depression, called *the pit of the stomach*, and in adult subjects ends above the navel at a transverse line, supposed to be drawn between the last false ribs on each side.

80. This region is subdivided into three parts, one middle, named *epigastrium*, and two lateral, termed *hypochondria*. The epigastrium takes in all that space which lies between the false ribs of both sides, and the hypochondria are the places covered by the false ribs.

81. The umbilical region begins in adults, above the navel, at the transverse line already mentioned, and ends below the navel at another transverse line, supposed to be drawn parallel to the former, between the two cristæ of the *Offa Ilium*.

82. This region is likewise divided into three parts, one middle, which is properly the *regio umbilicalis*, and two lateral, called *ilia* or *the flanks*; and they comprehend the space between the false ribs and upper part of the *Os Ilium* on each side.

83. The hypogastric region is extended downward from the inferior limit of the umbilical region, and is divided into three parts, one middle, called *pubis*, and two lateral, called *inguina*, or *the groins*.

84. The lumbar region is the posterior part of the abdomen, and comprehends all that space which reaches from the lowest ribs on each side, and the last vertebra of the back, to the *Os Sacrum* and neighbouring parts of the *Offa Ilium*. The lateral parts of this region are termed the *loins*, but the middle part has no proper name in men.

85. Lastly, the bottom of the abdomen which answers to the pelvis of the skeleton, is terminated anteriorly by the pudenda or parts of generation, and posteriorly by the clunes or buttocks, and anus. The buttocks are separated by a fossa, which leads to the anus, and each buttock is terminated

ed downward by a large fold which distinguishes it from the rest of the thigh.

86. This lumbar region takes in likewise the musculus quadratus lumborum on each side, the lower portions of the sacro-lumbares, of the longissimi and latissimi dorsi, the musculus facer, &c.

87. The space between the anus, and the parts of generation, is called *perineum*, and is divided into two equal lateral parts by a very distinct line, which is longer in males than in females, as we shall see in another place.

88. The cavity of the abdomen, formed by the parts already mentioned, (all which are covered by the skin and *membrana adiposa*,) is lined on the inside by a particular membrane, called *peritonæum*. It is separated from the cavity of the thorax by the diaphragm, and terminated below by the muscoli levatores ani.

89. This cavity contains the stomach, and the intestines, which are commonly divided into three small portions, named *duodenum*, *jejunum*, and *ilium*; and three large, called *cæcum*, *colon*, and *rectum*. It contains likewise the mesentery, mesocolon, omentum, liver, gall-bladder, spleen, pancreas, glands of the mesentery, *vasa lactæa*, *receptaculum chyli*, kidneys, renal glands, ureters, bladder, and the internal parts of generation in both sexes.

90. The principal arteries of the abdomen, are these: Arteria epigastrica superior, which is the lowest portion of the *mammariâ interna*. Aorta inferior. Arteria cæliaca. Arteria mesenterica superior. Arteriæ renales, called formerly *emulgentes*. Arteriæ spermaticæ. Arteria mesenterica inferior. Arteriæ lumbares. Arteriæ iliacæ. Arteriæ hypogastricæ. Arteriæ epigastricæ inferiores. Arteriæ hæmorrhoidales. Arteriæ pudicæ.

91. The principal veins of the abdomen are these: The inferior portions of the *venæ mammariæ internæ*. *Venæ renales*. *Venæ lumbares*. *Venæ spermaticæ*. *Venæ iliacæ*. *Venæ hypogastricæ*. *Vena portæ ventralis*. *Vena portæ hepatica*. *Vena mesariaca major*. *Vena splenica*. *Vena mesaraica minor* sive hæmorrhoidalis interna.

92. The principal nerves of the abdomen are these: *Nervi stomachici*, formed by the extremity of the sympathetic medii, or eighth pair. *Nervi sympathetici maximi*, the in-



ferior portion. The two semilunar or plexiform ganglions. Plexus stomachicus. Plexus hepaticus. Plexus splenicus. Plexus renales. Plexus mesentericus superior. Plexus mesentericus inferior. Nervi lumbares. Nervi sacri. Nervi crurales, their origin. Nervi sciatici, their origin.

*Parts of the upper extremities.*

93. The whole arm is divided, as in the skeleton, into the shoulder, the arm properly so called, the fore-arm, and the hand. But to these we must here add the stump of the shoulder, the axilla or arm pit, the elbow, the fold of the arm, and the hollow of the hand.

94. What is called the *stump* of the shoulder, is formed by the fleshy belly of the musculus deltoides; and the axilla, by the corresponding edges of the pectoralis major and latissimus dorsi. The elbow answers to the olecranium; the fold of the arm is on the fore-side of the articulation of the Os Humeri, with the bones of the fore-arm, and the hollow of the hand is in the middle of the palm.

95. The arm, properly so called, is principally covered from the shoulder downward, by the biceps, brachialis, and the three anconæi. The fore-arm is furnished with those muscles which move the radius on the ulna, and the carpus on the fore-arm. The hand has few very considerable fleshy parts, except the thenar and hypothenar, between which the hollow of the hand is formed.

96. The arteries of the whole upper extremity are these: Arteria axillaris. Arteria humeralis. Arteriæ scapulares. Arteria articularis. Arteria brachialis. Arteriæ collaterales. Arteria cubitalis. Arteria radialis. Arteria interossea anterior. Arteriæ interossee posteriores. The arterial arches in the palm of the hand.

97. The veins of the whole upper extremity are these: Vena cephalica minor. Vena jugularis externa, by communication with the small cephalica. Vena axillaris. Venæ musculares. Venæ scapulares. Vena brachii cephalica. Vena brachii basilica. Venæ satellites arteriæ brachialis. Vena profunda superior. Vena mediana, viz. mediana cubitalis, mediana basilica, mediana radialis sive cephalica, and mediana media or major. Vena profunda cubiti. Vena basilica cubiti sive cubitalis. Vena cephalica cubiti sive radialis. Venæ cubiti



cubiti satellites. Vena cephalica pollicis. Vena salvatella five auricularis. Areolæ venosæ dorſi manus.

98. The nerves of the whole upper extremity, are theſe : Nervi brachiales in general, formed by the laſt four or five cervical and firſt dorſal pairs. Nervus muſculo-cutaneus. Nervus medianus. Nervus cubitalis. Nervus cutaneus internus. Nervus radialis. Nervus axillaris five articularis.

99. The lower extremities of the whole body are divided, as thoſe of the ſkeleton, into *Parts of the lower extremities.* the thigh, leg, and foot.

100. The thigh begins anteriorly on one ſide of the fold of the groin; and poſteriorly, a little above the lower half of the buttock. It terminates anteriorly at the patella on the knee, and poſteriorly at the poples or ham. It is formed chiefly by muſcles the which ſurround the Os Femoris, and are themſelves inveſted by the fascia lata, viz. the gluteus maximus, two vaſti, crureus, biceps, triceps, ſemi-membranoſus, ſemi-tendinoſus, gracilis internus, gracilis anterior or rectus, and ſartorius.

101. The leg has but very few muſcles on the fore-part, but a great many large ones behind; where the gaſtrocnemii and ſoleus form a kind of belly, called the *calf of the leg*. The leg begins anteriorly at the knee, below the patella, and poſteriorly at the poples; and it terminates below, at the ancles,

102. Beſides the parts of the foot mentioned in the deſcription of the ſkeleton, that convex part near its articulation with the leg is termed the *neck of the foot*; and the under part, which is the baſis of the whole lower extremity, the *ſole of the foot*. The fleſhy parts are not more conſiderable on the foot than on the hand.

103. The arteries of the whole lower extremity are theſe : Arteria obturatrix, a branch of the hypogaſtrica. Arteria glutæa, a branch of the hypogaſtrica. Arteria ſciatica, by communication. Arteria pudica, by communication. Arteria cruralis. Arteria poplitea. Arteria tibialis anterior. Arteria tibialis poſterior. Arteria peronea. Arteria plantaris.

104. The veins of the whole lower extremity are theſe : Vena obturatrix. Vena glutea. Vena cruralis. Vena magna ſaphena. Vena ſciatica. Vena parva ſaphena five ſaphena externa.

externa. Vena poplitea. Venæ tibiales. Vena peronea. Vena plantaris.

105. The nerves of the whole lower extremity are these: Nervus cruralis, formed by a complication of the five lumbares, especially of the first four. Nervus sciaticus, formed by the union of the last two lumbares, and first three sacri. Nervus sympatheticus maximus, by communication with the nervi lumbares and sacri. Nervus popliteus. Nervus sciaticus internus, five popliteus internus. Nervus sciaticus externus, five popliteus externus. Nervus plantaris externus. Nervus plantaris internus.

## A R T. II.

### *A description of the common integuments of the body.*

*Introduction.* 106. **A**LL the parts of the human body are invested by several common and universal coverings, to which anatomists give the name of *integuments*.

107. There have been many disputes about the number of these integuments. The ancients reckoned up five, viz. the epidermis, skin, membrana adiposa, panniculus carnosus, and membrana muscutorum communis.

108. The first three of these coverings are truly common or universal, that is, extended over all parts of the body; but, properly speaking, they ought to be reduced to two, for I look upon the epidermis rather as a part or an epiphysis of the skin, than as an integument.

109. The two other coverings mentioned by the ancients, are not universal, but confined to particular parts of the body.

### § 1. *The skin.*

110. The skin is a substance of very large extent, made up of several kinds of tendinous, membranous, vascular, and nervous fibres, the intertexture of which is so much the more wonderful as it is difficult to unfold; for their directions are as various as those of the stuff of which an hat consists.

111. This

111. This texture is what we commonly call *leather*, and it makes, as it were, the body of the skin. It is not easily torn, may be elongated in all directions, and afterwards recovers itself, as we see in fat persons, in women with child, and, in swellings; and it is thicker and more compact in some places, than in others.

112. Its thickness and compactness are not, however, always proportionable; for on the posterior parts of the body, it is thicker and more lax than on the fore-parts; and on the palms of the hands, and soles of the feet, it is both very thick, and very solid. It is generally more difficult to be pierced by pointed instruments in the belly, than in the back.

113. The outer surface of this substance is furnished with small eminences, which anatomists have thought fit to call *papillæ*, in which the capillary filaments of the cutaneous nerves terminate by small radiated pencils.

114. These *papillæ* differ very much in figure and disposition, in the different parts of the body, and they may be distinguished into several kinds.

115. The greatest part of them is flat, of different breadths, and separated by sulci, which form a kind of irregular lozenges. The pyramidal figure ascribed to them, is not natural, and appears only when they are contracted by cold, by diseases, by boiling, or by some other artificial preparation which alters their ordinary structure.

116. The *papillæ* of the palm of the hand, of the sole of the foot, and of the fingers and toes, are higher than on the other parts of the body; but they are likewise smaller, closely united together, and placed, as it were, endwise, with respect to each other, in particular rows, which represent on the skin all kinds of lines, straight, crooked, waving, spiral, &c. These several lines are often distinctly visible in those parts of the palm of the hand, which are next the first phalanges of the fingers.

117. The red part of the lips is made up of *papillæ*, representing very fine hairs or villi closely united together.

118. There is another particular kind under the nails; the *papillæ* being there more pointed, or in a manner conical, and turned obliquely toward the ends of the fingers. Those which are found in the hairy scalp, scrotum, &c. are still of other kinds.

119. The

119. The papillæ of the first and second kinds appear to be surrounded, at their bases, by a soft mucilaginous and pretty viscid substance, which fills the interstices between them, and represents a kind of net-work or sieve, the meshes or holes of which surround each papilla. This substance is commonly called *corpus reticulare* or *mucosum*.

120. The origin of this reticular or mucous body has not hitherto been sufficiently explained, and it has not been determined, whether it forms an universal integument, or whether it belongs more properly to the skin, than to the papillæ and epidermis.

121. To demonstrate this reticular substance in public courses, the common method is to take the boiled tongues of oxen or sheep; but this method is fallacious, and may lead the greatest number of the spectators into mistakes, as I shall show in another place.

122. In inflammations we observe a reticular texture of capillary vessels, more or less extended on the surface of the skin; and curious anatomists demonstrate the same thing, by fine injections, which may be looked upon as artificial inflammations. But neither of these methods proves, that, in the natural state, these vessels are blood-vessels, that is, that they contain the red portion of the blood.

123. It is more probable that this vascular texture is only a continuation or production of the very small capillaries of the arteries and veins, which in the natural state transmit only the serous part of the blood, while the red part continues its course through wider ramifications, which more properly retain the name of *blood-vessels*.

124. This vascular texture is of various forms and figures in the different parts of the body. It is not the same in the face, with what it is elsewhere, neither is it alike on all the parts of the face, as may be discovered by the most ordinary microscopes; and from hence we might perhaps be enabled to give a reason, why one part of the body turns red more easily than another.

125. The inner surface of the skin is covered by very small tubercles called commonly *cutaneous glands*; and they are likewise termed *glandulæ miliares*, because of some resemblance which they are supposed to bear to millet-seeds.

126. These tubercles are partly fixed in small fossulæ, in the  
the



the substance of the skin, which answer to the same number of small cavities, in the corpus adiposum. Their excretory ducts open on the outer surface of the skin, sometimes in the papillæ, and sometimes on one side of them, as may be seen in the ends of the fingers, even without a microscope.

127. The greatest part of them furnishes sweat, and others a fatty, oily matter of different thickneses, as in the hairy scalp, in the back, behind the ears, and at the lower part of the nose, where this matter may be squeezed out, in form of small worms. On the head, this is called the *dandriff*, and *filth* or *naughtiness* on the other parts of the body.

128. By macerating the skin in water, or in any other proper liquor, these corpuscles become more visible, especially in the skin of the lower part of the nose, and of the axilla. The late M. Duvernay demonstrated to the royal academy, that the structure of some of these cutaneous glands resemble the circumvolutions of small intestines plentifully stored with capillary vessels. The illustrious M. Morgagni professor at Padua has given the name of *glandulæ sebaceæ* to those which furnish the unctuous matter above mentioned.

129. Besides these corpuscles, there are other small solid bodies, almost of an oval figure, contained in the substance of the skin. These are the roots or bulbs from whence the hairs arise, and some of them are situated within the inner surface of the skin, as I shall shew hereafter.

130. The skin has several considerable openings, some of which have particular names; such as the fissure of the palpebræ, the nares, the mouth, the external foramen of the ears, the anus, and openings of the parts of generation.

131. Besides these, it is perforated by an infinite number of small holes, called *pores*, which are of two kinds. Some are more or less perceivable by the naked eye; such as the orifices of the milky ducts of the mammae, the orifices of the excretory canals of the cutaneous glands, and the passages of the hairs.

132. The other pores are imperceptible to the naked eye, but visible through a microscope; and their existence is likewise proved by the cutaneous transpiration, and by the effects of topical applications; and from these two phenomena, they have been divided into arterial and venal pores.

133. We ought likewise to observe the adhesions and folds

of the skin. It is every where united to the corpus adiposum, as shall be shewed hereafter. But it adheres to it much more closely in some parts, than in others, as in the palm of the hand, sole of the foot, elbow, and knee.

134. Some plicæ or folds in the skin, depend on the structure of the membrana adiposa or cellularis, as those in the neck and buttocks; others do not depend on that membrane, such as the rugæ in the forehead, palpebræ, &c. which are formed by cutaneous muscles, and disposed more or less in a contrary direction to these muscles. These folds increase with age.

135. There is besides, a particular kind of folds in the skin of the elbow, knee, and condyles of the fingers and toes, which are owing neither to the conformation of the membrana adiposa, nor to any muscle.

136. Lastly, there is a kind of plicæ, or rather lines, which cross the palm of the hand, sole of the foot, and corresponding sides of the fingers and toes in different directions. These serve for employment to fortune tellers, whose pretended art is contrary to religion, and despised by all men of sense.

## § 2. *The cuticula or epidermis.*

137. The outside of the skin is covered by a thin transparent web, closely joined to it, which is called *epidermis*, *cuticula*, or the *scarf-skin*.

138. The substance of the cuticula appears to be very uniform on the side next the skin, and to be composed, on the other side, of a great number of very fine small squamous laminæ, without any appearance of a fibrous or vascular texture, except some small filaments by which it is connected to the papillæ, and which perhaps are detached from thence.

139. This substance is very solid and compact, but yet capable of being extended and thickened, as we see by steeping it in water, and by the blisters raised on the skin by vesicatories, or any other means; and from thence it would seem, that it is of a spongy texture. It yields very much in swellings; but not so much as the skin, without breaking or cracking.

140. The origin of the epidermis is as obscure, as its regeneration

generation is evident, sudden, and surprising; for let it be destroyed ever so often, it still grows again. It probably arises from a substance that transudes from the papillæ, and therefore the ancients were in the right to call it *an effluence of the skin*.

141. We must not however imagine, that it is the air which dries this mucilaginous matter, and gives it the form of the epidermis; because it is found equally in the foetus, which swims continually in water; and it grows even on the palate when it has been destroyed by too hot food; and under plaisters applied to any part of the body.

142. Hard and reiterated frictions loosen it insensibly, and presently afterward, a new stratum arises, which thrusts the first outward, and may itself be loosened, and thrust outward by a third stratum, and so on.

143. It is nearly in this manner, that callosities are formed on the feet, hands, and knees; and the several laminae or strata observable at the same time, on many other parts of the body, are owing to the same cause, though many anatomists have looked upon them to be natural. It must be acknowledged, however, that on the palms of the hands, and soles of the feet, the epidermis is commonly thicker than on any other part.

144. The epidermis adheres very closely to the cutaneous papillæ, from which it may be separated by boiling; or, which is a much better way, by steeping, for a long time, in cold water. It is not impossible to separate it with the knife, but this management teaches us nothing of its structure.

145. It adheres still closer to the corpus reticulare, which is easily raised along with it; and they seem to be true portions or continuations of each other.

146. It is generally believed, that the colour of the epidermis is naturally white; and that the apparent colour thereof is owing to that of the corpus mucosum. But when we examine separately the epidermis of negroes, we find no other whiteness in it, than in a thin transparent lamina of black horn.

147. The epidermis covers the skin through its whole extent, except at the places where the nails lie. It is marked with the same furrows and lozenges as the skin, and has the same openings and pores; and though it may be said to



pass the bounds of the skin, where it is continued inward, through the great openings, yet at these places it loses the name of epidermis.

148. When we examine narrowly the small pores or holes, through which the sweat passes, the epidermis seems to enter these, in order to complete the excretory tubes of the cutaneous glands. The fossulæ of the hairs have likewise the same productions of the epidermis, and it seems to give a sort of coat or bark to the hairs themselves. Lastly, the almost imperceptible ducts of the cutaneous pores are lined by it.

149. Having macerated the skin for a long while in water, the epidermis, with all its elongations, may be separated from it; and in that case these productions carry along with them, the hairs, the bulbs, and even the axillary glands.

150. By this observation, we may explain, how blisters may remain for a long time on the skin, without giving passage, through these holes, to the matter which they contain; which holes ought to be increased, one would think, by this dilatation and tension of the epidermis.

151. For when the epidermis is separated from the skin, it carries along with it some parts of these cutaneous fibres, which being compressed by the matter contained in the blister, shut the pores of the separated epidermis, like so many valves; and it is probably these small portions which have been taken for valves of the cutaneous tubes.

### § 3. *Uses of the skin.*

152. It is chiefly and properly the filamentary substance, called the *body of the skin*, which is the universal integument of the body, and the basis of all the other cutaneous parts, each of which has its particular uses.

153. The skin is able to resist external injuries to a certain degree, and such impressions, frictions, strokes, &c. to which the human body is often liable, as would hurt, wound, and disorder the parts of which it is composed, if they were not defended by the skin.

154. The papillæ are the organ of feeling, and contribute to an universal evacuation, called *insensible transpiration*. They likewise serve to transmit from without, inwards, the subtle particles or impressions of some things, applied to the skin.

The



The first of these three uses depends on the extremities of the nerves, the second on the arterial productions, and the third on the productions of the veins.

155. The cutaneous glands secrete an oily humour of different consistencies, and they are likewise the origin of sweat. But without the epidermis, both papillæ and glands would be disturbed in their functions, on which great disorders must ensue.

156. In order to explain the mechanism of feeling, or of the touch, we should first be made acquainted with the senses in general, for which this is not a proper place; and therefore all that I should observe here, is, that there are at least two sorts of feeling, one general, the other particular.

157. Particular feeling is accompanied with a certain determinate impression, by which we are enabled to discern objects in a very distinct manner, and this is properly what is called the *touch*; the proper organ of which is at the inside of the ends of the fingers. General feeling is indeterminate and indistinct, not being accompanied with the same impression as the former.

158. These differences in the sense of feeling, depend on those of the papillæ, which, in effect, appear to be more close, and made up of a greater number of nervous filaments at the ends of the fingers, than any where else; for the nervous ropes that go to the fingers are proportionably larger than those that go to any other part of the body.

159. The epidermis serves to keep the pencils or nervous filaments of the papillæ, in an even situation, and without confusion, and it likewise moderates the impressions of external objects. Particular as well as general feeling is more or less perfect, in proportion to the thinness of the epidermis, callosities in which weaken, and sometimes destroy both.

160. Another use of the epidermis is to regulate the cutaneous evacuations already mentioned, the most considerable of which is insensible transpiration. By this we understand a fine exhalation, or a kind of subtile smoke, which flows out of the body imperceptibly, and in different quantities. It might be called *cutaneous transpiration*, to distinguish it from pulmonary transpiration, of which hereafter.

161. This cutaneous exhalation becomes sensible, by applying the end of the finger, or palm of the hand, to the surface

face of a looking-glass, or of any other polished body; for it presently looks dull, and appears to be covered with a condensed vapour. It seems to me, that the convex side of the hand and fingers does not furnish so great a quantity of this exhalation, as the palm of the hand, and the insides of the fingers, especially the extremities; which points out one use of this transpiration, viz. to keep the nervous filaments in due order for particular feeling.

162. Another proof of insensible transpiration, is the famous experiment of Sanctorius, continued for thirty years without interruption, by which he found, that this evacuation in one day was equal to all the sensible evacuations for fifteen days.

163. This calculation is not agreeable to what has been made in other countries, particularly those from the like experiments made by M. Dodart and Morin of the royal academy of sciences, and by Dr. James Keill, as published in his *Statica Britannica*. Neither can the balance inform us, whether the cutaneous transpiration is greater or less than the pulmonary.

164. A long time ago, I discovered a method to render this transpiration visible, to the distance of about half a foot from the body, and I mentioned it in a thesis printed at Copenhagen. If we look at the shadow of a bare head on a white wall, in a bright sun-shiny day, and in the summer season, we will perceive very distinctly the shadow of a flying smoke, rising out of the head, and mounting upward, though we cannot see the smoke itself. We may try the same experiment with a dog or fowl, &c.

165. It is much in the same manner, that the invisible exhalations from burning charcoal throw a very distinct shadow; and that the invisible smoke of a chafing-dish, warming-pan, stove, &c. make all distant objects appear trembling, when viewed either over or on either side of those utensils.

166. The insensible cutaneous evacuation is performed simply, and without any artifice, through the small pores already mentioned, much in the same manner as we observe the smoke to arise from the intrails of an animal newly killed and opened. It is a particular and continual discharge of the serum of the blood through the capillary vessels of the skin.

167. It is naturally very moderate, and it is more abundant in the summer, before a good fire, after strong exercise, and during the distribution of the chyle; than in the winter, in cold places, during inaction, and before meals.

168. The transpired matter appears to be in some degree saline, as may be observed by applying the tongue to the palm of the hand, when it has not been washed lately before. This is perhaps the reason, why we feel less pain when a wound is touched with the finger covered with silk, than with the naked finger; but this inconveniency might easily be prevented by washing the hands and fingers very well immediately before we begin to dress wounds.

169. The matter of the other two cutaneous evacuations, the sweat and thick oily substance, comes chiefly from the glands of the skin. Each of them differs according to the different parts of the body where they are found, as may be observed both of the filth and sweat of the head, arm-pits, hands, feet, &c.

170. This filth or nastiness of the skin is an unctuous or fatty matter, collected insensibly on the epidermis, where it thickens and forms a sort of varnish, which in time becomes prejudicial, by stopping up the passages of cutaneous transpiration.

171. This collection is more readily made in winter, than in summer; and this is the reason why it is more difficult to keep the hands clean in cold, than in warm weather. And while I am dissecting in winter, the oftener I wash my hands, the less sensible they are of cold.

#### § 4. *The membrana adiposa, and fat.*

172. The second universal integument of the human body, is the *membrana adiposa*, or *corpus adiposum*. This is not, however, a single membrane, but a congeries of a great number of membranous laminæ, joined irregularly to each other at different distances, so as to form numerous interstices of different capacities, which communicate with each other. These interstices have been named *cellulae*, and the substance made up of them, *the cellulous substance*.

173. The thickness of the *membrana adiposa*, is not the same all over the body, and depends on the number of laminæ,



na, of which it is made up. It adheres very closely to the skin, runs in between the muscles in general, and between their several fibres in particular, and communicates with the membrane, which lines the inside of the thorax and abdomen.

174. This structure is demonstrated every day by butchers, in blowing up their meat, when newly killed; in doing which, they not only swell the *membrana adiposa*, but the air insinuates itself likewise in the interstices of the muscles, and penetrates even to the viscera, producing a kind of artificial emphysema.

175. These cellular interstices are so many little bags or satchels, filled with an unctuous or oily juice, more or less liquid, which is called fat; the different consistence of which depends not only on that of the oily substance, but on the size, extent, and subdivision of the cells.

176. It is generally known, that the illustrious Malpighi took a great deal of pains about this substance; that in birds and frogs, the viscera and vessels of which are transparent, he thought he saw a kind of ductus adiposi; and that, by pressing these ducts, he observed oily drops to run distinctly into the small ramifications of the *vena portæ*.

177. The manufacture of soap, the composition of the unguentum nutritum, and the different mixtures of oils with saline and acid liquors, give us some idea, at least, of the formation of the fat in the human body; but the organ which separates it from the mass of blood, which ought to be the subject of our present enquiry, is not as yet sufficiently known.

178. Fat is more fluid in living, than in dead bodies. It melts with the heat of the fingers in handling it, and its fluidity is in part obstructed by the sacculi, which contain it. To take it entirely out of these bags, the method is to set the whole over the fire, in a proper vessel; for then the bags burst, and swim in clusters in the true oily fluid.

179. This substance increases in quantity in the body, by rest and good living; and, on the contrary, diminishes by hard labour, and a spare diet. Why nourishment should have this effect, is easy conceived; and it is likewise easy to see, that an idle sedentary life must render the fat less fluid, and consequently more capable of blocking up the passages of



of insensible transpiration, through which it would otherwise run off.

180. Hard labour dissolves it, and consequently fits it for passing out of the body, with the other matter of insensible transpiration. Some are of opinion, that it returns into the mass of blood, by the capillary veins, and that it can, for some certain time, supply the want of nourishment.

181. By this, they think, the long abstinence of some animals may be explained; but I am apt to believe, that the mere decrease of cutaneous transpiration, occasioned by the continual rest and inaction of these animals, has a great share in this effect.

182. The proportional differences, in the thickness of this *membrana adiposa*, are determined, and may be observed to be regular in some parts of the body, where either beauty or use required it.

183. Thus we find it in great quantities, where the interstices of the muscles would otherwise have left disagreeable hollow or void places; but being filled, and as it were padded with fat, the skin is raised, and an agreeable form given to the part.

184. The appearance of a person moderately fat, of a person extremely lean, and of a dead carcase, from which all the fat has been removed, proves sufficiently what I have said.

185. In some parts of the body the fat serves for a cushion, pillow, or mattress, as on the buttocks, where the *laminæ* and cells are very numerous. In other parts, this membrane has few or no *laminæ*, and consequently little or no fat, as on the forehead, elbows, &c.

186. In some places it seems to be braced down by a kind of natural contraction in form of a fold; as in that fold which separates the basis of the chin from the neck; and in that which distinguishes the buttocks from the rest of the thigh. We observe it likewise to be entirely sunk, or as it were perforated by a kind of dimple or fossula, as in the navel of fat persons.

187. These depressions and folds are never obliterated, let the person be ever so fat, because they are natural, and depend on the particular conformation of the *membrana adiposa*, the *laminæ* of which are wanting at these places.

188. The fat is likewise of great use to the muscles in pre-

erving the flexibility necessary for their actions, and in preventing or lessening their mutual frictions. This use is of the same kind with that of the unctuous matter found in the joints, which was explained in the description of the fresh bones.

189. Lastly, the fat, as a fine oily substance in its natural state, may be some defence against the cold, which we find makes more impression on lean than on fat persons. It is for this reason, that to guard themselves against the excessive colds of hard winters, and to prevent chilblains, travellers rub the extremities of their bodies, and especially their feet, with spirituous oils, such as that of turpentine, &c.

190. This mass of fat, which makes an universal integument of the body, is different from that which is found in the abdomen, thorax, canal of the spina dorsa, articulations of the bones, and in the bones themselves.

191. But the difference of all these particular masses of fat consists chiefly, as I have said, in the thickness or fineness of the pellicles, in the largeness or smallness of the cells, and in the consistence, fluidity, and subtilty of the oily matter.

#### § 5. *The nails.*

192. The nails are looked upon by some as productions of the cutaneous papillæ, and by others, as a continuation of the epidermis. This last opinion agrees with experiments made by maceration, by means of which the epidermis may be separated entire from the hands and feet, like a glove or sock.

193. In this experiment we see the nails part from the papillæ, and go along with the epidermis, to which they remain united like a kind of appendix; and yet their substance and structure appears to be very different from that of the epidermis.

194. Their substance is like that of horn, and they are composed of several planes of longitudinal fibres soldered together. These sit at the extremity of each finger, and are nearly all of an equal thickness, but of different lengths.

195. The external plane or stratum is the longest, and the rest decrease gradually; the innermost being the shortest; so that

that the nail increases in thickness from its union with the epidermis where it is thinnest, to the end of the finger where it is thickest.

196. The graduated extremities or roots of all the fibres of which these planes consist, are hollowed for the reception of the same number of very small oblique papillæ, which are continuations of the true skin, which having reached to the root of the nail, forms a semilunar fold in which that root is lodged.

197. After this semilunar fold, the skin is continued on the whole inner surface of the nail, the papillæ insinuating themselves in the manner already said. The fold of the skin is accompanied by the epidermis, to the root of the nail exteriorly, to which it adheres very closely.

198. Three parts are generally distinguished in the nail, the root, body, and extremity. The root is white and in form of a crescent; and the greatest part of it is hid under the semilunar fold already mentioned.

199. The crescent and the fold lie in contrary directions to each other. The body of the nail is naturally arched, transparent, and appears of the colour of the cutaneous papillæ which lie under it. The extremity of the nail does not adhere to any thing, and still continues to grow as often as it is cut.

200. The principal use of the nails is to strengthen the ends of the fingers and toes, and to hinder them from being inverted towards the convex side of the hand or foot, when we handle or press upon any thing hard. For in the hand, the strongest and most frequent impressions are made on the side of the palm, and in the foot, on the sole; and therefore the nails serve rather for butteresses than for shields.

§ 6. *The hairs.*

201. The hairs belong as much to the integuments as the nails. They are a kind of reeds or rushes, the roots or bulbs of which lie toward that side of the skin which is next the membrana adiposa. The trunk or beginning of the stem perforates the skin, and the rest of the stem advances beyond the outer surface of the skin, to a certain distance, which is very various in the different parts of the body.



202. When the different hairs are examined by a microscope, we find the roots more or less oval, the largest extremity being either turned toward or fixed in the corpus adiposum. The smallest extremity is turned toward the skin, and in some places fixed in the skin.

203. This oval root is covered by a whitish strong membrane, in some measure elastic; and it is connected either to the skin, to the corpus adiposum, or to both, by a great number of very fine vessels and nervous filaments.

204. Within the root, we observe a kind of glue, some very fine filaments of which advance toward the small extremity, where they unite and form the stem, which passes through this small extremity to the skin. As the stem passes through the root, the outer membrane is elongated in form of a tube which closely invests the stem, and is entirely united to it.

205. The stem having reached the surface of the skin, pierces the bottom of a small fossula between the papillæ, or sometimes a particular papilla, and there it meets the epidermis, which seems to be inverted round it, and to unite with it entirely. A sort of unctuous matter transudes through the sides of the fossula, which is bestowed on the stem, and accompanies it more or less, as it runs out from the skin, in form of an hair.

206. Hairs differ in length, thickness, and solidity, in the different parts of the body. Those on the head, are called in English by the general name of *hairs*; those which are disposed archwise above the eyes, *supercilia* or the *eye-brows*; those on the edges of the palpebræ, *cilia*, or the *eye-lashes*; and those which surround the mouth, and cover the chin, the *beard*. In other parts of the body, they have no particular names; and their different lengths, thicknesses, &c. in all these parts, are sufficiently known.

207. Their natural figure seems to be rather cylindrical than angular, which is chiefly accidental. Their colour is probably the same with that of the glue, or medullary matter of the root, the different consistence of which makes the hairs more or less hard, flexible, &c. Lastly, their straight or crooked direction must depend on that of the holes through which the stems pass.

208. The use of the hairs, with respect to the human body



dy in general, is not sufficiently known to be determined with certainty. Their uses, with regard to some particular parts may be discovered, as we shall see in the description of these parts.

§ 7. *The supposed integuments of the ancients.*

209. Besides the integuments which I have here described, the ancients reckoned two others, the panniculus carnosus, and membrana communis musculorum.

210. The panniculus carnosus is found in quadrupeds, but not in men, whose cutaneous muscles are in a very small number, and most of them of a very small extent, except that which I call musculus cutaneus in particular; but even that muscle cannot in any tolerable sense be reckoned a common integument.

211. There is no common membrane of the muscles, which covers the body like an integument; it being no more than particular expansions of the membranes of some muscles, or aponeurotic expansions from other muscles.

212. The elongations of the lamina of the membrana adiposa or cellularis, may likewise have given rise to this mistake, especially in such places, where this membrane is closely united to the proper membrane of the muscles.

S E C T. VIII.

*A description of the ABDOMEN.*

1. **I**N the compendious view of the parts of the human body, I gave a general description and division of the abdomen, with a particular enumeration of the external and internal parts of which it is composed, and which it contains or supports. Therefore that I may not be obliged to repeat these general things, I must desire the reader to revise what was there said before he begins this section. *Introduction.*

2. The whole fore-part of the abdomen forms an oblong convexity, like an oval vault, more or less prominent in the natural

*External conformation of the abdomen.*

natural state, in proportion to the quantity of fat upon it, and of food contained in it, or to the different degrees of pregnancy in women.

The hypogastric and umbilical regions are more subject to these varieties, than the epigastric region.

3. On the sides, between the hypochondria, and *Ossa Ilium* or haunch, the abdomen is commonly a little contracted; and backward, about the middle of the *regio lumbaris*, it is gently depressed, forming a kind of transverse cavity, answering to the natural incurvation of the lumbar portion of the *spina dorsa*, described in sect. I.

4. This anterior convexity, and posterior cavity change, as we sit, stand, kneel, lie at our full length, or with the thighs bent; and these variations depend on the particular situation of the *Ossa Innominata*, in these different postures.

5. In standing, the convexity of the belly, and cavity of the loins, are more considerable, than in most other situations: for then the lower extremity of the *Os Sacrum* is turned very far back, and consequently the *Os Pubis* very much down. In this situation of the pelvis, the intestines fall naturally forward, and thus increase the convexity of the abdomen; and as the vertebræ of the loins are very much bent at the same time, the cavity in that place must likewise be very considerable.

6. In kneeling, the *Ossa Pubis* are still lower than when we stand; and this not only increases the hollow of the loins, and throws the abdomen and its viscera more outward or forward, but also in some measure strains the abdominal muscles; which is so uneasy to some persons, as to cause them to faint away.

7. This depression of the *Os Pubis* in kneeling depends partly on the tension of the two *musculi recti anteriores*, the lower tendons of which are, in this situation drawn with violence under the condyloide pulley of the *Os Femoris*.

8. When we sit in the common manner, that is, with the thighs stretched out in a plain parallel to that of the seat, the convexity of the belly and hollow of the loins diminish.

9. For the pelvis being in this situation, supported on the *tubercula ischii*, and these tubercles being very near the forepart of the pelvis; the trunk of the body pressing on the *Os Sacrum*, must lower the pelvis behind, and raise it before.

10. When

10. When we lie upon the back at full length, and with the thighs extended, the belly is less convex, but more stretched and hard; whereas, when the thighs are bent, it is soft and lax. In this situation, the regio lumbaris is almost flat, and very little depressed.

11. When we lie on the back, and raise the head, or endeavour to raise it, we feel a tension in the fore-part of the abdomen, which increases in proportion to the force we use in raising the head.

12. These varieties of the external conformation of the abdomen have a near relation to so great a number of other phænomena, in the animal œconomy of the human body, that it would require a whole volume to explain all the particulars thereof; neither are details of this kind very proper in a work designed to be purely anatomical, in which, consequently, our main business is to give a full and accurate description of the true structure of the parts, and only to point out in general their principal uses. The rest I resolve to make the subject of another work as I have already said.

13. I mentioned the integuments of the abdomen in general, in the compendious view of the parts. Fewer papillæ appear in the skin of the belly than any where else. The anterior portion of it is not only thinner and more compact than the posterior, as has been already observed, but it has this likewise peculiar to it, that it may be naturally increased very much in breadth, and sometimes in a very extraordinary manner, without losing any thing of its thickness, in proportion to what it gains in breadth.

*Integuments of  
the abdomen.*

14. This peculiarity likewise belongs to the epidermis. I here speak only of what is observable, in the natural state of corpulency or pregnancy, but I have not as yet been able to discover, what it is in the texture or structure of this skin and epidermis, on which this peculiarity depends. All that I have been able to remark about it was in the dead body of a woman, whose belly was contracted and fallen; namely, that on the surface of the skin there was a great number of lozenges disposed in a reticular manner.

15. The marks of these superficial lozenges were in the epidermis. They were composed of several fine lines, which altogether extended to a sensible breadth. The areas or  
meshes



meshes of these lozenges, which seemed to be about the sixth part of an inch in breadth, were very flat and thin.

16. In the manner in which Steno used to open bodies, by making two longitudinal incisions in the integuments, and so leaving a middle band made up of the skin and fat, in their true places, it is easy to demonstrate the union of the aponeurotic or tendinous productions with the arteries, veins, and nerves, in order to form the skin of the abdomen; and the same use might be made of this method, in other parts of the skin, as I shall show in another place.

17. The cells of the membrana adiposa, which covers the convex part of the abdomen, are disposed in a very regular manner, as I discovered by that method of opening bodies, which I have always made use of, both in my public and private courses. This method is to make two oblique incisions in the integuments, from the navel to the groins, and to separate this angular portion of the integuments, and throw it down over the parts of generation, that they may be covered, during the demonstration.

18. This triangular portion being thus inverted, there appears on the inner surface of the membrana adiposa, a longitudinal line like a kind of raphe, produced by the meeting of these cellular rows, which form angles successively, one above another, opposite to the linea alba of the abdomen. The cells in these rows are more oblong than the rest, and in a manner oval, or like a grain of wheat.

19. The appendix ensiformis of the sternum, the cartilaginous portions of the last pair of true ribs; those of the first four pairs of false ribs, all the fifth pair, the five lumbar vertebræ, the Ossa Innominata, the Os Sacrum, and Os Coccygis, form the bony sides of the cavity of the abdomen.

20. The diaphragm, the muscles called particular *musculi abdominis*, the *quadrati lumborum*, *psoai*, *iliaci*, the muscles of the coccyx, and of the *intestinum rectum*, form the chief part of the circumference of this cavity; and its whole inner surface is lined by a membranous expansion, termed *peritoneum*, all these parts being covered by the integuments already spoken to. As additional or auxiliary parts, we might likewise add some portions of the sacro-lumbares, *longissimi dorsi*, *vertebrales*, *glutæi*, &c.

21. The



21. The cavity of the abdomen is of an irregularly oval figure, but still symmetrical. On the fore-side it is uniformly arched or oval, and its greatest capacity is even with the navel, and nearest part of the hypogastrium. On the upper side it is bounded by a portion of a vault, very much inclined. On the back-side, it is in a manner divided into two cavities by the jetting out of the vertebræ of the loins. On the lower side, it contracts gradually all the way to what I call the little edge of the pelvis, and from thence expands again a little, as far as the Os Coccygis, and tubercles of the ischium, terminating in the void space between these three parts.

### § 1. *Peritonæum.*

22. Having carefully removed the muscles of the abdomen, the first thing we discover is a very considerable membranous covering, which adheres immediately to the inner surface of the muscoli transversi, and of all the other parts of this cavity; and involves and invests all the viscera contained therein, as in a kind of bag. This membrane is named *peritonæum*, from a Greek word, which signifies to be spread around.

23. The *peritonæum* in general is a membrane of a pretty close texture, and yet very limber and capable of a very great extension; after which it can recover itself, and be contracted to its ordinary size; as we see in pregnancy, dropsies, corpulency, and repletion.

24. It seems to be made up at least of two portions, one internal, the other external; which have been looked upon by many anatomists, as a duplicature of two distinct membranous laminæ. But, properly speaking, the internal portion alone deserves the name of a *membranous lamina*, as being the main body of the *peritonæum*. The external portion is no more than a kind of fibrous or follicular apophysis of the internal; and may properly enough be termed the *cellular substance of the peritonæum*.

25. The true membranous lamina, commonly called the *internal lamina*, is very smooth, and polished on that side which is turned to the cavity and viscera of the abdomen, and continually moistened by a serous fluid discharged through almost imperceptible pores.

26. These pores may be seen by spreading a portion of the peritonæum on the end of the finger, and then pulling it very tight on all sides; for then the pores are dilated, and small drops may be observed to run from them, even without a microscope.

27. The sources of this fluid are not as yet sufficiently known. Perhaps it comes out by a kind of transfusion or transpiration, like that which we observe in animals newly killed. The whitish corpuscles found in diseased subjects are no proof of the glands, which some anatomists place there in the natural state.

28. The cellular substance or external portion of the peritonæum, adheres very closely to the parts which form the insides of the cavity of the abdomen, and it is not every where of an equal thickness. In some places it is in a very small quantity, and scarcely any appears at the tendinous or aponeurotic portions of the musculi transversi, and on the lower side of the diaphragm.

29. In all other places, it is thicker, and forms cells expanded into very fine laminæ, which in diseased subjects become sometimes so broad and thick, as to resemble so many distinct membranes.

30. In some places, this substance is every way like a membrana adiposa, being filled with fat, as round the kidneys, and along the fleshy portions of the transverse muscles to which it adheres. It entirely surrounds some parts, as the bladder, ureters, kidneys, spermatic vessels, &c. and it is in these places improperly termed the *duplicature of the peritonæum*.

31. Besides these differences in thickness, the cellular substance has several elongations, which have been called *productions of the peritonæum*. Two of these productions accompany and invest the spermatic ropes in males, and the vascular ropes, commonly called the *round ligaments*, in women. There are other two, which pass under the ligamentum Fallopii, with the crural vessels, which they involve, and they are gradually lost in their course downward.

32. To these four productions of the cellular substance of the peritonæum, we may add a fifth, which is spread on the neck of the bladder, and perhaps a sixth, which accompanies the intestinum rectum. All these elongations pass out of the  
cavity

cavity of the abdomen, and may be termed *external*, to distinguish them from others that remain in the abdomen, and are called *internal*, of which hereafter.

33. The great blood-vessels, that is, the aorta and vena cava, are likewise involved in this cellular substance of the peritonæum. In a word, it involves immediately and separately all the parts and organs, which are commonly said to lie in the duplicature of the peritonæum.

34. The true lamina or membranous portion of the peritonæum, is connected by the intervention of the cellular substance, to the inner surface of the cavity of the abdomen, but it does not naturally accompany the external elongations of that substance. It only covers the origin or basis of these productions, without any alteration in its own surface, at these places.

35. It has, nevertheless, productions of its own, but they are very different from those of the cellular substance; for they run from without, inward, that is, they advance from the convex side of the great bag of the peritonæum, into the cavity of that bag, some more, some less, and also in different manners; as if the sides of a large ball or bladder were thrust inward into the cavity of the ball or bladder.

36. Of these internal elongations or intropressions of the true lamina of the peritonæum, some are simply folded, like a duplicature; some are expanded like inverted bags or sacculi to contain some viscus; some begin by a simple duplicature, and are afterwards expanded into a cavity which contains some organ; some are alternately extended in the form of simple duplicatures, and of cavities; and lastly, some form only a small eminence on the inner surface of the great cavity of the peritonæum.

37. Under the first species of these productions, we may bring the membranous ligaments of the abdomen, such as those of the liver, colon, &c. We see the second species in the external membrane of the liver; the third, in the mesentery; the fourth, in the mesocolon; and the fifth, at the kidneys and ureters.

38. Besides the external productions of the cellular substance of the peritonæum, it has the same number of internal elongations with the true lamina; which lie between all the



uplicatures, and line the insides of all the cavities, or that side next the viscera contained in them.

39. The uses of the peritonæum in general seem to be very evident from the description which I have given of it; and the chief of these uses are, to line the cavity of the abdomen, to invest the viscera contained in that cavity as in a common bag to supply them with particular coats, to form productions, ligaments, connections, folds, vagina, &c. as we shall see hereafter.

40. The fine fluid which transudes through the whole internal surface of the peritonæum, prevents the inconveniences which might arise from the continual frictions and motions, to which the viscera of the abdomen are exposed either naturally or by external impulses.

41. I must here observe, that it is the common custom to demonstrate four ligamentary ropes, termed the *umbilical vessels*, before the peritonæum is opened, because they adhere to the umbilicus, and three of them are really vessels in the fœtus, viz. two umbilical arteries, and one vein. We are in a manner obliged to submit to this custom, in public anatomical demonstrations, where we have but one subject for the whole; but as I am here under no such necessity, I refer the description of these ligaments to other more proper places of this work. The venal ligament shall be described in the history of the liver; and the two arterial ligaments, together with the urachus, which is the fourth, in the history of the bladder.

42. It is sufficient to observe here in general, that three of these umbilical ropes or ligaments are involved separately, and sustained by a production or duplicature, which the peritonæum sends into the cavity of the abdomen, in form of a falx. In the public dissections and demonstrations which I made at the physic-schools in 1726, I shewed the manner of demonstrating these falces, and of distinguishing them from the ligamentary ropes.

## § 2. *Ventriculus.*

*Situation and figure of the stomach.*

43. The stomach is a great bag or reservoir, situated partly in the left hypochondrium and partly in the epigastrium.

44. The



44. The figure of the stomach is like that of a bag-pipe, that is, it is oblong, incurvated, large and capacious at one end, and small and contracted at the other. We see this figure most evidently, when the stomach is moderately filled with air or with any other fluid.

45. The curvature of the stomach gives us occasion to distinguish two arches in it, one large, which runs along the greatest convexity, and one small, directly opposite to the former. I name these arches the great and small curvatures of the stomach; and by the sides of the stomach, I understand the two lateral portions which lie between the two arches.

46. The stomach has two extremities, one large, and one small like a crooked funnel. It has two openings, called the *orifices of the stomach*, one between the great extremity and the small curvature, the other at the end of the small or contracted extremity. The first opening is a continuation of the œsophagus; the other joins the intestinal canal, and is called by the name of *pylorus*.

47. The stomach is not situated in the left hypochondrium, and epigastric region, in the manner represented in most of the figures. It lies transversely, obliquely, and almost laterally, in such a manner, as that the great extremity and the orifice next it, are on the left hand, and the small extremity with its orifice or the pylorus, on the right hand, and lower and more inclined than the former. Therefore we ought, with the ancient anatomists, to call one of these orifices *superior*, the other *inferior*.

48. The great extremity of the stomach is in the left hypochondrium, and for the most part immediately under the diaphragm. Yet the superior orifice is not in the left hypochondrium, but almost opposite to, and very near the middle of the bodies of the lowest vertebræ of the back.

49. The small extremity of the stomach does not reach to the right hypochondrium. It bends obliquely backward toward the upper orifice, so that the pylorus lies about two fingers breadth from the body of the vertebræ immediately under the small portion of the liver, and consequently lower down, and more forward than the other orifice, by almost the same distance. This extremity of the stomach has some times

times a particular dilatation on the side next the great curvature.

50. According to this natural situation, the stomach, especially when full, lies so as that the great curvature is turned more forward than downward, and the small curvature more backward than upward.

51. One of the lateral convex sides is turned upward, the other downward; and not forward and backward as they appear in dead bodies, where the intestines do not support them in their natural situation.

52. If we divide the stomach along the two curvatures into two equal parts, we shall see that the two orifices do not both adhere to the same half of this division, as we would be apt to imagine according to the common notion; but that the diaphragmatic orifice is entirely in the upper half, and the intestinal orifice in the lower half.

53. Therefore the body of the stomach is so far from lying in the same plane with the œsophagus, as it is commonly represented in figures drawn from a stomach taken out of the body and laid upon a table; that it forms an angle or fold, immediately at the passage of the œsophagus through the small muscle of the diaphragm; and it is on account of this angle that the superior orifice is turned backward.

54. The stomach is composed of several parts, the chief of which are the different strata which form its substance, to which anatomists give the name of *tunicae* or *coats*. These coats are commonly reckoned to be four in number, the outer or common, the fleshy or muscular, the nervous or aponeurotic, and the villous or inner coat; and they are afterwards subdivided several ways.

55. The first or outermost coat is simply membranous, being one of the internal productions of the peritonæum. This appears evidently at the connection of the superior orifice with the diaphragm, where the external membrane of the stomach is really continuous with the membrane, which lines the inferior surface of the diaphragm; and it is from this that it has been named the *common coat*.

56. The second or muscular coat is made up of several planes of fibres, which may all be reduced to two, one external, the other internal. The external coat is longitudinal, though in different respects, following nearly the direction

tion of the curvatures and convexities of the stomach; and the internal plane is transversely circular.

57. The fibres of the external plane run slanting in several places, and are intersected by small oblique whitish lines, which seem to be in some measure tendinous. This plane is strengthened by a particular fasciculus which runs along the small curvature, its fibres appearing to be less oblique than those of the great plane.

58. The fibres of the inner or circular plane of this muscular coat are stronger than those of the outer plane. They are rather segments which unite at different distances, than entire circles; and they are likewise intersected by great numbers of small white lines, in some measure tendinous, and very oblique, which all together represent a kind of net-work, the areolæ or meshes of which are very narrow.

59. As these circles or segments advance on the great extremity of the stomach, they diminish gradually, and form a kind of muscular vortex, the centre of which is in the middle of that extremity.

60. Between the outer and inner planes, round the superior orifice, there are two distinct planes, about the breadth of a finger, and very oblique, which surround this orifice in opposite directions, and intersect each other where they meet on the two lateral sides.

61. Along the middle of each lateral side of the small extremity, there runs a tendinous or ligamentary flat portion, above a quarter of an inch in breadth, which terminates in the pylorus. These two portions lie between the common and muscular coats, and adhere very strongly to the first.

62. Between the same two coats, there is a cellular substance which adheres very closely to the external coat, and insinuates itself between the fleshy fibres of the second, all the way to the third, as may be perceived by blowing it up. Some make it a distinct coat, and call it *tunica cellulosa*; but it is no more than the cellular portion of the membranous coat, like the cellular portion of the peritonæum.

63. The third coat, called commonly *tunica nervosa*, sustains on its convex side, a very large reticular distribution of capillary vessels and nerves. On the concave side it seems to be of a very loose texture, and as it were spongy or filamentary, containing a great number of small glandular bodies, especially



especially near the small curvature and small extremity of the stomach.

64. This spongy texture resembles fine cotton, as may be seen, by macerating it a little in clear water, which swells it considerably in a very short space of time. It is supported by a kind of ground-work of very fine ligamentary or aponeurotic filaments which intersect each other obliquely, much in the same manner as the third coat of the intestines, of which hereafter; and it adheres to the convex side of the villos coat.

65. The fourth coat of the stomach is termed *villosa*, because when it swims in clear water, some have imagined they saw something in it like the pile of velvet. The ancients called it *tunica fungosa*, and perhaps this name agrees best with its true structure. We observe in it a great number of small holes answering to the small glands already mentioned.

66. These two coats are of a larger extent than the two former, and they join in forming large rugæ on the concave surface of the stomach, the greatest part of which is transverse, though irregular and waving. There are likewise some longitudinal ones, which intersect the others, but at the pylorus they all become longitudinal, and terminate there.

67. At the superior orifice of the stomach, these rugæ are in a manner radiated, and seem to be a continuation of the plicæ or folds of the œsophagus; only they are thicker, and where these rugæ and plicæ meet, they form a sort of crown, which distinguishes the superior orifice of the stomach from the inferior extremity of the œsophagus.

68. In the interstices of these rugæ, there is often found a sort of slimy mucus, with which the whole cavity of the stomach seems likewise to be moistened. This mucus is much more fluid in living bodies, and is supplied by the glands of the stomach. It may be termed *jucus gastricus* or *stomachicus*.

69. On the inner surface of the small extremity of the stomach, at the place where it ends in the intestinal canal, we observe a broad, thin, circular border, with a roundish hole in the middle. This hole is the inferior orifice of the stomach, called by the Greeks *pylorus*, which signifies a porter.

70. This border is a fold or duplicature of the two inner coats of the stomach, the nervosa and villosa; and it is formed



ed in part by a fasciculus of fleshy fibres fixed in the duplicature of the tunica nervosa, and distinguished not only from the other fleshy fibres of the extremity of the stomach, but also from those of the intestines, by a thin, whitish circle, which appears even through the external or common coat, round the union of the stomach and intestines.

71. The figure of the pylorus is that of a ring, transversely flattened, the inner edge of which, or that next the centre, is turned obliquely toward the intestines, like a broad portion of a funnel. This inner edge runs naturally more or less into little plaits or gathers, like the mouth of a purse almost shut; all which particulars are very different from what figures and dried preparations would make us believe. It is therefore a kind of sphincter, which can contract the inferior orifice of the stomach, but seems not capable of shutting it quite close.

72. The principal arteries of the stomach are the coronaria ventriculi, which runs along the small curvature, and the two gastricae, that is, the sinistra or major, and dextra or minor, both which form one common artery, which runs along the great curvature. The coronaria ventriculi becomes united in the same manner with the pylorica, and both make one common vessel.

*Arteries of  
the stomach.*

73. These two arterial arches send a great number of branches toward each other on both sides of the stomach; and these branches are gradually ramified in different directions, by very different divisions and subdivisions, the greatest part of which communicate with those from the other artery.

74. From these frequent ramifications and communications of the arterial arches of the stomach, two different reticular textures arise, whereof one which is the largest lies between the common and muscular coats in the cellular substance found there; the other, which is very fine, lies on the surface of the tunica nervosa. This latter is a production of the first, being formed by means of a great number of very short rami, which go out from the other, and pass through the small interstices between the fibres of the muscular coat.

75. By artificial injections we can shew a third extremely fine reticular texture of capillary vessels, which run between the glandular bodies and papillae of the tunica villosa. These

do not seem in the natural state to be purely blood-vessels, as inflammations and injections may incline us to think.

76. The arteries of the stomach come originally from the cœliaca, by means of the hepatica, splenica, and coronaria, The pylorica and mesenterica superior likewise contribute to them by communications, more or less immediate. They communicate also with the mammariæ internæ and diaphragmaticæ, and, by means of the epigastrica sinistra, with the mesenterica inferior.

77. The veins of the stomach are ramifications of the vena portæ in general, and in particular, of the mesenterica major, splenica, and hæmorrhoidalis interna, the distribution of which may be seen in the description of the veins. They accompany the arteries more or less, and form nearly the same kinds of arches and reticular textures, with this difference, that they are proportionably greater, their reticular areolæ larger, and their external communications more frequent.

78. Between the common and muscular coats of the stomach, we find a great number of nerves of different sizes. Many of them accompany each other, in form of a broad flat fasciculus, along the small curvature of the stomach, from the superior to the inferior orifice. The rest are spread in different directions, on the sides, extremities, and great curvature, forming at different distances a kind of reticular plexus, from which a great number of filaments are detached to the inner coats.

79. They arise chiefly from the nervi sympathetici medii, or eighth pair, by means of the plexus coronarius stomachicus formed round the superior orifice of the stomach, by the expansion of the extremities of two large ropes, which run down upon the œsophagus, by the name of *nervi stomachici*. The great sympathetic nerve, commonly called *intercostalis*, contributes likewise to them, by communicating filaments, which the plexus stomachicus receives from the semilunar ganglions of the plexus hepaticus, and particularly from the plexus splenicus.

80. The stomach receives in general, whatever the mouth and tongue send thither, through the canal of the œsophagus; but its particular use is to receive the aliments, to contain them for a longer or shorter time,

time, in proportion as they are more solid or fluid, and to digest them, that is, to put them in a condition to be turned into that nutritious fluid, called *chyle*.

81. This operation which goes by the general name of *digestion*, and by which chylication begins, is performed partly by the *succus gastricus*, which flows continually from the *tunica villosa*, and partly by the continual contraction and relaxation of the muscular coat. These motions in men are but very weak, and nowise sufficient for digestion, without the assistance of the alternate motions of the diaphragm, and muscles of the abdomen.

82. The pylorus, or fleshy circle of the inferior orifice of the stomach, serves to retain the aliments in it, till they have acquired a sufficient degree of fluidity, to pass easily through that opening. I say easily, for by a particular irritation of the muscular coat of the stomach, and still more by a violent contraction of the diaphragm and muscles of the abdomen, the contents of the stomach may be very soon forced towards the small extremity, and pushed through the pylorus.

83. The gentle and alternate motions of the orbicular fibres of the muscular coat, may assist in sending through the pylorus, in the natural way, the aliment that is sufficiently digested. This was called the *peristaltic* or *vermicular motion*, by those who believed that it is successively reiterated, like that of earth-worms when they creep.

84. Trituration might be a proper enough term for this operation, provided it be made to signify only a gentle agitation or action of the fleshy fibres, in a substance continually moistened by the gastric liquor, and not a violent grinding of a dry substance.

85. The situation of the stomach, which is nearly transverse, is likewise of use in making the aliment remain long enough in that cavity, and may serve to make the length of this stay, in some measure, arbitrary, by means of the different postures of the body; for when we lie on the left side, the aliment must remain longer, than when we lie on the right, &c.

86. The obliquity of the stomach may serve to clear up a difficulty, that very much torments those who believe that both orifices of the stomach lie on the same level; which is,



how any heavy substance, once got into the stomach, can ever rise again to this level, to pass into the intestines.

§ 3. *The intestines in general, and intestinum duodenum in particular.*

*Situation, size, and division of the intestines.*

87. Between the pylorus and the very lowest part of the abdomen, lies a long canal, bent in a great many different directions, by numerous convolutions or turnings, called the *intestines*.

88. This canal thus folded and turned, forms a considerable bulk, which fills the greatest part of the cavity of the abdomen; and it is connected, through its whole extent, to membranous productions or continuations of the peritonæum, principally to those called the *mesentery* and *mesocolon*, of which hereafter.

89. The incurvations of the intestinal canal form two-arches; a small one by which it is connected to the mesentery and mesocolon, and a great one on the opposite side, which lies loose. The whole canal is generally about seven or eight times as long as the subject.

90. The intestinal canal is neither of an equal size nor thickness through its whole length, from whence anatomists have taken occasion to consider its different portions, as so many particular intestines, and to divide them all into small and great,

91. And as they still found some differences in each class taken all together, they divided each into three portions, which they distinguished by particular names. In the small intestines, the three portions are named *duodenum*, *jejunum*, and *ileum*; and in the great intestines, *cæcum*, *colon*, and *rectum*.

92. The intestines in general are composed of several coats, much in the same manner with the stomach. The first and outermost is a continuation of the mesentery, or of some other elongation or duplication of the peritonæum.

93. This is commonly termed the *common coat*, and it has a cellular substance on its inner surface, like that of the stomach, which M. Ruysch thought fit to call a distinct coat, by the name of *unica cellulosa*.

94. The

94. The second coat of the intestines is fleshy or muscular, and made up of two planes, one external, the other internal. The external plane is very thin, and its fibres longitudinal; the internal plane is thicker, and its fibres run transversely round the circumference of the intestinal cylinder.

95. I am not of opinion, that these fibres are spiral, nor that they are perfect circles or rings; but they seem rather to be segments of circles, disposed much in the same manner, as in the stomach, and thus surrounding entirely the intestinal canal.

96. These two planes adhere closely together, and are separated with great difficulty. They adhere likewise to the common coat, by the intervention of the cellular substance, which is in greater quantities on the side next the mesentery than on the other.

97. The third coat is called *nervosa*, and is something like that of the stomach. It has a particular plane, which serves as a basis to sustain it, made up of very fine, strong, oblique fibres, which seem to be of the ligamentary or tendinous kind.

98. To see this plane distinctly, a portion of the intestines must be inflated; the common coat removed, and the fleshy fibres scraped off.

99. This coat sustains two reticular substances which are both vascular, one arterial, the other venal, accompanied by a great number of nervous filaments. These vessels and nerves are productions of the mesenteric vessels and nerves; and as they surround the whole canal of the intestines, some anatomists have formed them into a distinct coat, by the name of *tunica vasculosa*.

100. The nervous coat sends off from its inner surface a great number of portions of septa, more or less circular, which contribute to the formation of what are called *valvulae conniventes*, of which hereafter. It likewise seems to sustain several different glandular bodies, which we discover in the cavity of the intestines.

101. The fourth or innermost coat is very soft, and is named *tunica villosa*. It has the same extent with the third coat, which supports it, and it lines all the septa of that third coat; but it is not uniform through the whole canal, as we shall shew in the particular description.

102. The

102. The small intestines form one continued uniform canal; and though three portions of it have three different names, yet we have no sufficient marks whereby to distinguish them, to fix the precise extent or length of each portion, or to settle its just limits.

*Intestina tenuia.* 103. The first and smallest portion of the whole canal, is called *duodenum*; the second, which is much longer, *jejunum*; and the third, which is still longer than the second, *ileum*.

*Situation and connection of the duodenum.* 104. The first portion of the small intestines was called *duodenum*, from the length ascribed to it by the ancients, viz. the breadth of twelve fingers; and the moderns need not cavil much about this length, if it is measured with the ends of the fingers of the subject.

105. This intestine having arisen from the pylorus, is immediately bent a little backward, and obliquely downward; then it bends a second time toward the right kidney, to which it is a little connected, and from thence passes before the renal artery and vein, ascending insensibly from right to left, till it gets before the aorta and last vertebræ of the back. It continues its course obliquely forward, by a gentle turn, which may be reckoned a third incurvation, and also the extremity of the duodenum.

106. Through this whole course, the duodenum is firmly bound down by folds of the peritonæum, especially by a transverse duplicature which gives origin to the mesocolon. The two laminæ of this duplicature being at first separate, and soon afterwards uniting, must leave a triangular space between them, which is lined with a cellular substance.

107. It is in this space that the duodenum adheres by means of the cellular substance to the parts already named; and the intestine is contained therein, as in a case, so that, without dissection, we can see nothing but its two extremities; and even these are hid by the colon, and by the first convolutions of the jejunum.

*Structure of the duodenum.* 108. The first coat of the duodenum is consequently different from that of the other small intestines, having this peculiar to it, that it does not invest the whole circumference of the intestine, because, through the greatest part of its length, it lies in the triangular space already mentioned; and for the same reason there



there is a greater quantity of cellular substance belongs to the outer coat of the duodenum, than to that of the other intestines.

109. The muscular coat of the duodenum is thicker than in the jejunum and ileum.

110. The tunica nervosa and villosa form conjointly, on the insides of this intestine, a great number of small duplicatures which advance into the cavity more or less directly, like portions of circular planes, with one edge fixed to the intestine, and the other, loose. These are what anatomists call *valvulae conniventes*.

111. The loose or floating edge of these valves, is formed into small gathers or waves in the natural state. I say designedly, in the natural state, to rectify the false ideas which dry preparations of the intestines are apt to beget. The whole surface of these duplicatures or valves is villous, as well as that of the intestines between them.

112. The villi of this intestine are thicker than in the stomach; but the texture of them in man, is not like hairs, as they are commonly represented in figures; but rather like that of a fungous, granulated substance, composed of an infinite number of very fine papillæ of different figures, in which we see, through a microscope, a multitude of depressed points or pores, by which their whole surface seems to be pierced.

113. By the same help we observe, on different places of the inner surface of this intestine, several round villous tubercles, rising like small verucæ at different distances from each other.

114. This substance sustains an infinite number of capillary vessels, of different kinds; for, besides the blood-vessels, we sometimes observe a great number of white filaments which run through it, and end at its inner surface, like so many capillary roots of the vessels, called *venæ lacteæ*.

115. The fungous substance which binds these capillary filaments together, and surrounds them, is very tender; and the capillary extremities of the small blood-vessels distributed through it, seem to be turned toward the pores of the papillæ. Through these pores, a mucous fluid, more or less transparent, is discharged, which continually moistens the cavity of the intestine.

116. The internal surface of the duodenum is furnished with

*Glands of the  
duodenum.*

with a great number of small flat glandular tubercles, raised on the sides, and depressed in the middle by a kind of fossula; and they are more numerous, near the beginning of this intestine than any where else. About the pylorus, they lie in a manner in heaps or clusters, and from thence the distance between them increases gradually all the way to the other extremity, where they are single.

117. These glands, when examined carefully, appear like little bladders, with the orifices turned toward the cavity of the intestine, and the bodies fixed in the spongy substance next the nervous coat. They furnish a particular fluid, which is often found to be viscid.

118. In the inner surface of the duodenum, almost at the lower part of the first incurvation, and on the shortest side there is a longitudinal eminence, in the point or apex of which lies a particular opening, which is the orifice of the ductus biliaris, within which the ductus pancreaticus likewise opens.

119. This intestine is commonly the widest, though the shortest of the intestina tenuia, and is invested by more cellular substances, especially while within its triangular case, where it wants the outer coat, which the others have; and consequently it is more easily dilatable, by the substances which might otherwise stick within it.

#### § 4. *Intestinum jejunum.*

*Situation and  
size of the je-  
junum.*

120. The jejunum, so called, because it is oftener found empty than the ileum, begins at the last incurvation of the duodenum, and is there connected to the beginning of the mesocolon.

121. From thence it bends downward from left to right, and obliquely forward, or from the vertebræ, and makes several convolutions, which lie chiefly in the upper part of the umbilical region. Through all this course it is connected to the mesentery, in the manner that shall be explained hereafter.

122. It is a pretty difficult matter to fix the exact bounds between this intestine and the ileum. The external marks of a redder colour in the one than in the other, though pretty common,

common, are not constant; and the internal marks fixed from the plurality of valvulæ conniventes are indeterminate, and oftentimes appear only from dissection.

123. These two intestines may be better distinguished by their different situations, which are pretty regular; but as even this mark is not particular enough, the most easy way that I have been able to contrive, and which will in most cases be found sufficiently exact, is to divide both intestines into five parts: and to allow nearly two fifths to the jejunum, and three fifths and a little more to the ileum.

124. The coats of the jejunum are nearly of the same structure with those of the duodenum, but thinner. The common coat is a continuation of the mesentery; and the cellular substance is in less quantity than in the duodenum; and indeed seems to be altogether wanting along the great curvature of the convolutions, where the longitudinal fibres of the muscular coat adhere very closely to the external membrane.

*Structure of the jejunum.*

125. This muscular coat is not so strong as that of the duodenum. The longitudinal plane of fibres is very thin, and almost imperceptible, except along the great curvature, opposite to the connection of the mesentery, where we see, through the membranous coat, a kind of whitish ligamentary band, about the third part of an inch in breadth, which is continued along the great curvature of all the convolutions of this intestine, and of the ileum.

126. This ligamentary band is like those which we observe on the sides of the small extremity of the stomach. It adheres perfectly to the membranous coat, and to the longitudinal fibres of the muscular coat, which are here more visible, and appear to be stronger than in any other place.

127. The tunica nervosa, which I chuse rather to call reticularis, and its proper cellular or languinous substance, have nothing peculiar to them more than has been already said about the intestines in general. By blowing artfully into this substance, it may be made to swell so much, round the whole cavity of the intestine, as to destroy all the duplicatures or valvulæ conniventes.

128. These valves in this intestine are very broad, very numerous, and very near each other. On the side of the great curvature, their circumference is continuous and uni-



form; but next the small curvature, there are several breaks in them, the extremities of some advancing beyond the rest, and terminating in points. Some of these valves go quite round, others only some part of the way, and some of them are very small, which go obliquely between two large ones, forming a kind of communication.

129. The papillæ of the tunica villosa are here more raised, more loose and floating than in the duodenum, and each of them seems to be divided into several others, by incisures of a very singular kind. In other respects they agree pretty much with what was said in the description of the intestines in general. The observations and figures published by M. Helvetius, first physician to the French Queen, in the memoirs of the royal academy, express these papillæ, and the whole tunica reticularis, very justly.

130. The glandular lacunæ of the jejunum are of the same structure with the glandulæ Brunneri or duodenales; but they are disposed in a different manner. They are partly single at different distances from each other, and partly in several clusters, like flat oblong bunches of grapes, called *plexus glandulosi Peyeri*. These are in the largest quantity near the great curvature, and they cross through several valvulæ conniventes at once.

131. The vessels, nerves, connections, &c. must be referred till the mesentery has been described.

### § 5. *Intestinum ileum.*

132. The convolutions of the intestinum ileum surround those of the jejunum on the two lateral and lower sides, and it passes in a winding course from the left side, by the hypogastrium, to the right side, where it terminates a little below the right kidney, joining the intestina crassa, in the manner that I shall relate hereafter. The lateral convolutions are supported by the Ossa Ilium, so called, not from this intestine, but from the region of the abdomen, termed *ilia*.

133. The structure of the ileum is much the same with that of the jejunum; only the internal duplicatures or valvulæ conniventes decrease gradually both in number and size. Near the extremity of the

*Situation of  
the ileum.*

*Structure of  
the ileum.*

the ileum their direction is changed, and instead of being transverse or circular, they become longitudinal, and terminate in a kind of pylorus which advances into the cavity of the great intestines, as we shall see presently.

134. We observe likewise in this intestine, as in the jejunum, single or solitary glands or lacunæ, and also reticular glands, or glands in clusters, the last of which, at the extremity of this intestine, is oftentimes of a great extent; but the greatest part of these glands appear to be flatter here than in the jejunum. The cellular substance of the external coat is in less quantities than in the foregoing intestines, and the ileum appears commonly more pale, or not so red as the jejunum.

135. The vessels, nerves, connections, &c. must be referred to the history of the mesentery.

§ 6. *The intestina crassa in general, and intestinum cæcum in particular.*

136. The great intestines are one continued canal, divided into three portions, like the small ones. This canal begins by a kind of sacculus or bag, which is reckoned the first of the three portions, and called *cæcum*. The second portion, called *colon*, is the longest of the three, and is distinguished from them by a great number of particular eminences or convexities, which appear on its outer surface through its whole length. The last portion is named *rectum*, being more uniform, narrower, thicker, and much shorter than the colon.

137. The structure of the great intestines is nearly the same with that of the small ones, in regard both to the number and disposition of their coats. They are shorter, and have fewer convolutions, but are much more capacious. The coats in general are stronger, but especially the muscular coat. The villi and mucilaginous glands are different, and there are several other things relating to them, which will come in better in the particular history.

138. The intestinum cæcum is only a round short broad bag, the bottom of which is turned downward, and the mouth or opening upward. It lies under the right kidney, and is hid by the last convolution of the ileum. It is about three fingers breadth in

*Situation and  
Structure of  
the cæcum.*

length, and its diameter is more than double that of the small intestines.

139. On one side of the bottom of the *cæcum* lies an appendix, resembling a small intestine, nearly of the same length with the *cæcum*, but very slender. It is termed *appendicula vermiciformis*, from its supposed resemblance to an earth-worm. Its common diameter is not above a quarter of an inch. By one extremity it opens laterally and a little obliquely into the bottom of the *cæcum*; and the other extremity is closed, being sometimes greater, sometimes smaller than the rest of the appendix.

140. It has some contortions, like those of a worm when it is touched, from whence comes the epithet of *vermicularis* or *vermiciformis*; and it may likewise be compared to the gills or pendants of a turkey-cock. Its structure resembles nearly that of the other intestines.

141. The internal coat of this appendix is folliculous, like that of the duodenum; and it is likewise reticular, the meshes being the glandular *lacunæ*, which continually discharge a fluid into its cavity.

142. It has been often disputed whether this appendix or the large portion, which is, as it were, the head of the colon, ought to be called the *cæcum*; but the general division of the intestines into great and small, leaves no room to doubt of its being only an appendix in man; whatever reason there may be for talking differently with respect to brutes and birds.

143. Through the membranous or common coat of the *cæcum*, we see three white ligamentary bands, which adhere very closely, both to the outer and muscular coat. One of them is hid by the adhesion of the *mesocolon*; and all the three divide the *cæcum* longitudinally into three parts more or less equal.

144. They all unite on the *appendicula vermiciformis*, and cover its whole outer side immediately under the common coat. Though they appear exteriorly on the *cæcum* to be ligamentary, they are made up interiorly of fleshy fibres which accompany and strengthen the longitudinal fibres of the muscular coat.

145. The villous substance of the inner coat of the *cæcum*



is very short, and furnished in several places with glandular lacunæ or solitary glands, broader than those of the small intestines.

146. These glandular lacunæ or folliculi are flattened and depressed in the middle like small-pox. When we blow through a pipe into these lacunæ without touching them, the folliculi are inflated, and represent little caps with a hole in the middle of their convex side.

### § 7. *Intestinum colon.*

147. The colon is the most considerable of all the intestines. From the cæcum, of which it is a continuation, it reaches, in form of an arch, above the umbilical region, and to the lower part of the left hypochondrium. Its continuity is however a little interrupted by the ileum, which advances into the cavity of the colon, and, together with a certain fold of that intestine, forms what is called *valvula coli*.

*Situation and  
structure of the  
colon.*

148. The whole convex side of the colon is divided longitudinally into three parts, by three ligamentary bands, continued from those of the cæcum, and of the same structure with these. Two of these bands run on each side, along the great curvature of the colon; and the third along the small curvature.

149. The uppermost band of the two that belong to the great curvature, is the broadest of the three; that which belongs to the small curvature is the narrowest, and lay hid by the connection of the mesocolon, till it was brought to light by M. Morgagni.

150. These three longitudinal bands do the office of longitudinal fræna, between which this intestine is through its whole length alternately depressed into transverse folds, and raised into considerable eminences. All the folds are duplicatures, which form portions of *valvulæ conniventes* in the cavity of the intestine; and the eminences form receptacles, called the *cells of the colon*.

151. All the coats of the colon concur equally to the formation of these duplicatures and cells, the depth of which decreases gradually toward the extremity of the intestine; and neither of them go any further than the ligamentary bands.

152. These

152. These portions of the colon which are immediately covered by the ligamentary bands, are smooth and without rugæ, and therefore if these bands alone are cut across, the intestine is not elongated sufficiently to destroy all the folds and cells.

153. The common coat on one side is a continuation of the mesocolon, and on the other side it contributes, by the same continuation, to form the omentum. The longitudinal fibres of the muscular coat are very slender; and those which answer to the annular or circular fibres of the small intestines, are only segments stretched over the eminences and folds. The other coats are nearly as in the cæcum; only the glandular lacunæ or solitary glands are broader and more numerous.

154. The arch of the colon begins under the right kidney, near the haunch. It runs up on the foreside of that kidney to which it is connected, passes under the vesicula fellis, which tinges it with a yellow colour at that place, and continues its course before the first incurvation of the duodenum, to which it adheres, and partly hides it. In this part of its course, therefore, there is a remarkable connection between the colon, duodenum, right kidney, and vesicula fellis.

155. From thence the arch of the colon runs before the great convexity of the stomach, and sometimes a little lower, then turns backward under the spleen, in the left hypochondrium, runs down on the foreside of the left kidney, to which it is connected; below this kidney turns toward the vertebræ, and terminates there by a double incurvation, or by two opposite convolutions, which represent in some measure an inverted Roman S.

156. These last convolutions of the colon are sometimes multiplied, and even advance to the right side of the pelvis; and along the great arch, and the two last incurvations, there are a kind of fringes, called *appendices coli adiposæ*, which I shall afterwards explain, as also the connections of the colon with the mesocolon and omentum.

157. At the place where the cæcum joins the colon, one portion of the circumference of both is depressed, and forms a large fold on the inside, which advances into the cavity of the intestine. It is a little open in the middle, and its extremities are very thick, by reason

*Valvula coli.*

of

of the mutual duplicature of the coats of the cæcum and colon.

158. The extremity of the ileum is as it were grafted in the opening of this fold, and strongly united to its sides by the adhesion of its transverse fibres, to the transverse fibres of the cæcum and colon.

159. This union forms a pretty thick ring, which likewise advances into the common cavity of the cæcum and colon, where it is wrinkled or formed into gathers, almost like the lower extremity of the œsophagus, the pylorus or inside of the anus. Its circumference is more or less oval, and, by a kind of continuity with the common fold of the cæcum and colon, it forms two productions, which M. Morgagni calls the *fræna of the valvula coli*.

160. The membranous coat of the extremity of the ileum is continued on the cæcum and colon, without sinking into any fold, at the place where the ileum enters the colon. The longitudinal fibres of the muscular coat seem here to be confounded with the nearest circular fibres of the cæcum and colon.

161. The inner portion of the muscular coat of the ileum runs in between the circular fibres of the ileum and colon, as into a common fold of these two intestines, from all which a pretty thick short portion of a fleshy tube is formed, which is the circular rising already mentioned.

162. The tunica nervosa and villosa of the extremity of the ileum likewise enter the common cavity of the cæcum and colon, and on the edge of the circular rising, join the like coats of these two intestines, so that the circular rising or short muscular tube is covered both on the outer and inner sides by a nervous and villous coat; that on the inside being supplied by the ileum, and the other by the two great intestines.

163. The best method to demonstrate the structure and composition of this valve, is in clear water, and by a particular section, while the intestine is fresh, and has not been altered by any disease, in the manner that I demonstrated publicly in the physic-schools in 1726. In another work, I shall explain particularly, the way of managing this and other such dissections the greatest part of which method, I have already communicated, both in my public and private courses.

164. The situation of this extremity of the ileum is most commonly transverse, and is inserted almost in the same direction



rection in the common cavity of the two intestines, already mentioned, but it is often a little more inclined toward the cæcum, than to the colon; and whereas in all other places, the ileum is wide and easily dilatable, it is very narrow at its insertion, and its sides more solid and firm.

165. It is chiefly in this structure that the mechanism of the insertion of the ileum, in the cæcum and colon consists; about which insertion or opening, authors are very much divided, some reckoning it a valve, others, only a sphincter.

166. It is very evident, from what I have said, that it is a double machine contrived to hinder the return of the excrements into the ileum, because it can produce this effect partly as a valve, and partly as a kind of sphincter. The dried preparations of this part give a very false idea of its structure and conformation; and the same thing is to be said of the opening of the appendicula vermiformis into the cæcum.

167. The capacious arch of the colon is connected by both extremities to the regio lumbaris, near the kidneys, by two particular ligaments, one on the right side, the other on the left, which are only small duplicatures of the peritonæum, more or less transverse.

168. The remaining portion, which forms the two convolutions in form of the Roman S, contracts below the left kidney, being narrower there, than lower down. The coats of this portion become gradually thicker and stronger, and likewise the ligamentary bands, which approach each other by degrees, and seem to increase in breadth.

169. The vessels, nerves, &c. will be found in the description of the mesentery.

#### § 8. *Intestinum rectum and anus.*

170. The last of all the intestines is named *rectum*, or the *Situation, figure, and size of the rectum,* *straight gut*, from its situation; for when viewed directly forward, it appears to run down in a straight course from the last vertebra of the loins, on the foreside of the Os Sacrum, all the way to the Os Coccygis, where it ends in what is called the *anus*.

171. This intestine, properly speaking, is a true continuation of the last convolution of the colon, and it is the repository, sink, and common sewer of the whole intestinal canal.

It

It has likewise a special relation to the bladder, and to the parts of generation in both sexes.

172. The rectum having passed below the last vertebra of the loins, to the inside of the Os Sacrum, is bent backward, on that concave side, to which it is connected, in the manner that shall be afterwards explained; and having reached the Os Coccygis, it runs likewise in the direction of that bone, and bends a little forward; terminating beyond the extremity of the coccyx.

173. The figure of this intestine varies according as it is full or empty. When empty, it is irregularly cylindrical, and sinks in by a kind of transverse folds, and in that state, it is about three fingers breadth in diameter more or less. When full, it is wider in proportion to the quantity of feces, wind, or whatever else is contained in it; and it may be extended to the size of a large bladder, so as to represent a kind of stomach.

174. The membranous coat often contains a great quantity of fat, spread between it and the muscular coat, and forming round the intestine numerous eminences, in the room of the appendices adiposæ of the colon, which shall be explained in the history of the omentum.

*Structure of the rectum.*

175. The muscular or fleshy coat is very thick; the longitudinal fibres, which in the other intestines are very thin, are in this stronger than the circular fibres of the rest. The ligamentary bands continue to increase in breadth, and to approach each other, as has been said; and it is to the fleshy fibres of these bands, that the thickness of the longitudinal fibres seems to be owing.

176. The nervous or filamentous and internal coats, are larger here, than in the other intestines; and when the rectum is empty, they form a great number of waving rugæ in its cavity, which disappear, in proportion as that cavity is filled.

177. The innermost coat is very improperly termed *villousa*, and scarce deserves the name of *papillaris*, because of the smallness of the little corpuscles, spread on its surface. It contains a great number of single or solitary glands; and it is always moistened by a mucus of different consistencies, dis-

charged by these glands or folliculi, and perhaps by the corpuseles also.

178. Near the extremity of this intestine the rugæ or folds become in a manner longitudinal, and at last, towards the circumference of the inner margin of the anus, they form little bags or semilunar lacunæ, the openings of which are turned upward, toward the cavity of the intestine. These lacunæ are something like those at the lower extremity of the œsophagus, or upper orifice of the stomach.

179. At length the extremity of the rectum contracts and terminates by a narrow orifice called the *anus*, the sides of which are disposed in close folds or gathers. This extremity of the intestine has several muscles belonging to it, some of which surround it like sphincters, the rest are broad fleshy planes inserted in it, and which being likewise fixed to other parts, sustain it in its natural situation, and restore it to that situation, when disturbed by the force necessary for the exclusion of the feces. These latter muscles are termed *levatori ani*, the first go by the general name of *sphincters*.

180. These sphincters are three in number, one intestinal or orbicular, and two cutaneous or oval; whereof one is large, superior, and internal; the other small, inferior, and external.

181. The intestinal or orbicular sphincter of the anus, consists merely in an augmentation of the inferior portion of the fleshy fibres of the extremity of the rectum.

182. In the description of the fresh bones, I omitted two ligaments, one called *ligamentum cutaneum Ossis Coccygis*, the other *ligamentum pubis interosseum*. This last I demonstrated in my public dissections in the year 1726, and the other about four years before. These two ligaments must be here described, before I proceed to the cutaneous sphincters.

183. The cutaneous ligament goes out anteriorly, from the extremity of the Os Coccygis. It is very slender, and divides into two portions at the orifice of the anus, which run into the membrana adiposa, and are inserted in the skin on each side of the anus, by a kind of expansion, and continuing to devaricate, they are lost on the two sides of the perineum.

184. The interosseous ligament of the Ossa Pubis is a very strong



strong triangular membrane, fixed by two of its edges in the inferior rami of these bones, all the way up to their common symphysis. The third edge, which is the lowest, is loose; and this whole membrane, the middle of which is perforated by a particular hole, is stretched very tight between the two bones, and under their cartilaginous arch, to which it adheres very closely.

185. At the lower part of this interosseous ligament, along its whole lower or loose edge, lies a digastric muscle, fixed by its two extremities in the rami of the *Ossa Pubis*, its middle tendon lying on the middle of the edge of the ligament. The description of that muscle does not belong to this place; and I mention it here only because of the relation it bears to the cutaneous sphincters of the anus. It is called by some, *musculus transversalis urethræ*; by others, *musculus triangularis*.

186. The cutaneous sphincters have each an anterior and posterior insertion, ending both ways in a kind of point, and comprehending the orifice of the anus, between their middle portions.

187. They are distinguished from each other by their situation, by their size, and by a kind of white cellular line. The greatest of the two appears to be double, and the smallest lies nearest the skin, and adheres most closely to it.

188. They are inserted backward, partly in the apex of the *Os Coccygis*; and partly in the contiguous portion of the cutaneous ligament of that bone. Forward their chief insertion is in the middle tendon of the *transversalis urethræ*; and they have likewise some connections to other muscles of the urethra, of which hereafter.

189. The *levator ani* are broad, thin, muscular portions, fixed by one extremity of their fleshy fibres round the concave side of the inferior portion of the pelvis, from the symphysis of the *Ossa Pubis*, beyond the spine of the ischium. The other extremity of these fibres runs down on each side behind, and under the curvature of the end of the rectum, where they meet together, and unite from the basis of the *Os Coccygis* all the way to the margin of the anus.

190. By their superior insertions, these portions are on each side of the pelvis divided into three classes, an anterior, middle, and posterior class. The two anterior classes reach from about the middle of the symphysis of the *Ossa Pubis*,

bis, to the upper border of the foramina ovalia of the pelvis. The middle classes continue the same course immediately above the insertion of the obturator internus, on the *Ossa ischium*, and a little on the *Ossa ilium*. The posterior classes are spread on the inner sides of the *Ossa ischium* to the spinal apophyses of these bones, and even a little beyond these, on the *ligamenta sacro sciatica*.

191. The anterior portions are in their passage connected to the prostate glands, to the neck of the bladder, to the bulb of the urethra, as shall be shewn in the description of these parts; and they sometimes send fibres to the *musculus transversalis urethræ* above mentioned.

192. The fibres of all these portions having by their superior insertions formed this large and ample circumference, run down obliquely from before backward, contracting in breadth, and approaching each other in the manner of truncated radii; and behind, and under the extremity of the rectum, they form a digastric muscle, something like the *mylo-hyoidæus*; which terminates the bony pelvis below; and forms the bottom of the cavity of the abdomen, as the diaphragm forms the upper part.

193. It is here necessary to observe that the muscles of the *Os Coccygis* described § 3. may be looked upon as assistants to the levatores.

194. We ought likewise to remark, that the margin or edge of the anus is formed by the union of the skin and epidermis, with the internal coat of the rectum; so that the most superficial portion of that coat seems to be a continuation of the epidermis.

195. I refer the arteries, veins, nerves, connections, uses, &c. to the place already mentioned in the description of the other intestines.

### § 9. *Mesenterium et Mesocolon.*

196. This great bundle of intestines is not left to move at random in the cavity of the abdomen; but artfully bound down by a membranous web, which prevents the intestinal convolutions from being intangled in each other, and from being twisted or compressed

*Division of the mesentery, &c.*

sed

fed in all their different ways of meeting; and yet allows them a gentle floating, but limited motion.

197. This web goes still by the ancient Greek name of *mesentery*, as being in some measure in the middle of the intestines. It is distinguished into two portions, one of which being very broad and very much plaited, connects the small intestines; the other, which is long and incurvated, does the same office to the great intestines.

198. These two portions are in reality only one and the same continuation of the membranous lamina of the peritonæum, doubled back upon itself, and they are distinguished only by their breadth. Taken both together, they form a kind of spiral roll, more or less plaited in its circumference. The first portion has retained the name of *mesentery*, the other is termed *mesocolon*.

199. The mesentery begins at the last incurvation of the duodenum, and runs obliquely from left to right, along the vertebræ of the loins. In this space, the membranous portion of the peritonæum is detached on both hands, produces a duplicature by two elongations or particular laminæ applied to each other, and thus forms the mesentery.

*Structure of the  
mesentery, &c.*

200. It is narrow at its upper and lower parts, but chiefly at the upper. The middle portion is very broad, and the edge of it next the intestines is every where very much plaited. These plaits or folds are only waving inflexions, such as may be observed in the edge of a piece of shamoy, which has been often drawn through the fingers. They make this edge of the mesentery very long, and they run through about one third of its breadth.

201. The two laminæ are joined together by a cellular substance, which contains glands, vessels, and nerves, that shall be described hereafter; and in some subjects it has a great quantity of fat, which keeps the two laminæ at a good distance from each other.

202. Along the whole circumference of the mesentery, the two laminæ are naturally separated, and applied to the two sides of the small intestines which they invest by their union or rather reciprocal continuation on the great curvature of that canal, and carry it as in a scarf or sling. This

is



is what forms the external or membranous coat of the intestines.

203. The mesocolon is the continuation of the mesentery, which having reached the extremity of the ileum, contracts and changes its name. At this place the particular lamina which is turned to the right side, forms a small transverse fold, called *ligamentum coli dextrum*.

204. Afterwards the mesocolon ascends toward the right kidney, where it seems to be lost by the immediate adhesion of the colon to that kidney, and to the first incurvation of the duodænum. Then it appears again, and increasing in breadth, it continues its course almost transversely under the liver, stomach, and spleen, where it begins to turn downward, under the left hypochondrium toward the kidney on the same side.

205. Through this whole course, the mesocolon extends in breadth, and forms nearly a transverse semicircular plane, very little plaited at its great circumference. By this circumference or edge, it is connected to the colon; and hides that ligamentary band of this intestine, which runs along its small curvature. By its short or small edge, it forms the triangular case of the duodenum, and by its great edge, the external coat of the colon, in the same manner as the mesentery does that of the small intestines. As it passes under the large extremity of the stomach, it adheres a little to the lower portion of that extremity, as the diaphragm does to the upper.

206. Having got below the left kidney, it contracts and forms another transverse fold, called *ligamentum coli sinistrum*. Afterwards it expands again, but not so much as in the upper part, and runs down on the left psoas muscle, toward the last vertebræ of the loins. This descending portion is fixed to the convolutions of the colon, in the same manner as the superior portion is to the arch of that intestine.

207. The intestinum rectum is likewise invested by a particular production of the peritonæum, called commonly by the barbarous name of *meso-rectum*. This production is very narrow, and about the middle of the foreside of the rectum, it forms a transverse semicircular fold which appears when the intestine is empty; but is lost, when it is filled.

§ 10. *Glandula mesenterica, vasa lymphatica & lactea.*

208. Between the laminae of the mesentery, a great number  
of

of glands lie scattered through the cellular substance. In the natural state, these glands are something of the figure of lentils or little round beans, some of them being orbicular, others oval, but all of them a little flatted, and in corpulent subjects we find them surrounded with fat

*Glands of the mesentery.*

209. These glands are of the number of those that anatomists call *glandulae conglobatae*, the structure of which is not as yet sufficiently known. They seem to be of a cellular substance, surrounded by a very fine membrane or coat, on which, by the help of microscopes, we discover an intertexture, of particular filaments, which Malpighi believed to be fleshy fibres,

210. The nicest anatomical injections have not hitherto given us any satisfaction about these particulars; for though they be made with all possible care, they always fill the folliculous texture of these glands, and though by means of these injections we may discover a great many vessels, which were before invisible, we are not a whit the nearer our purpose, because we cannot by this method distinguish the secretory, excretory, and blood-vessels from each other.

211. Besides the blood vessels, which are distributed in a reticular manner in the mesenteric glands, and besides many nervous filaments spread through them; we discover an infinite number of small vessels of another kind, running from gland to gland.

*Lymphatic vessels.*

212. These vessels are extremely thin and transparent, and furnished on the inside with numerous valves, which appear on the outside like little small knots very near each other. They go out from each gland by ramifications, as by so many roots, and having formed a small trunk, they are again divided, and enter some neighbouring gland by the same kind of ramifications by which they went out from the former.

213. They are termed *lymphatic vessels*, because for the most part they contain a very clear, limpid, though mucilaginous serum, called *lymph* by anatomists. But as they have likewise been observed to be filled with a white milky fluid, called *chyle*, they have been called *vasa chyliifera*, or *vena lactea*. They have the name of *veins*, because their valves are disposed as those of the ordinary blood-

*Lacteal vessels.*

blood-veins, and because the fluid which they contain runs from smaller into larger tubes.

214. I have always divided the lacteal vessels into three classes in the human body, and sometimes into four.

215. They derive their first origin from the tunica villosa of the intestines, and chiefly from that of the small intestines, by a great number of small-capillary roots, as has been already said. From these roots there arises, between the coats of the intestines, a kind of rete mirabile, which surrounds almost the whole circumference of the intestinal canal, between the muscular and external coat.

216. This reticular texture of lacteal vessels keeps close to the external coat, and leaves the canal along with it, on the side of the mesentery, where it forms two planes of ramifications, plainly distinguished from each other by the cellular substance, and adhering closely to the inside of the two membranes of the mesentery. In this separate state they run on the laminae of the mesentery as far as the first mesenteric glands, where they unite again into one plane. All this I reckon the first class of lacteals.

217. After this union the lacteal vessels are distributed almost uniformly through the whole extent of the mesentery from its circumference to its origin or adhesion to the vertebræ of the back, between the mesenteric glands, which they join in the manner already said, and form frequent anastomoses or communications. This is the second class.

218. Having passed through the mesentery in this manner, the ramifications begin to unite as they approach the spina dorsii, and consequently their number is lessened, and their size increased; and having passed the last mesenteric glands, they terminate about the middle of the adhesion of the mesocolon in small common trunks, which receive a great number of lymphatic vessels from the glandulæ lumbares, and others below these. This is the third class.

219. A fourth class may be made of the lacteal vessels of the great intestines; of which I demonstrated several very full of chyle, to the royal academy, in an human colon. The late M. Mery, a member of the same academy, who was not easily convinced of any thing, from observations made by others, having seen, that, with the end of my finger, I could push the white liquor uniformly into the colon in several places,



places, seemed at first to be satisfied; but, for his further conviction, he desired me to open one of these vessels before him, with the point of a lancet, and to take out a drop of the liquor, which having laid upon the nail of my thumb, he was entirely convinced.

220. The lacteal vessels are not always apparent in human subjects. But we may see them in those who die either a violent or sudden death, soon after a <sup>meal</sup> ~~meal~~; and they remain visible even in the intestines, for a long time after death, when a great number of the mesenteric glands have become scirrhous, especially in children.

221. It is the common custom to demonstrate the lacteals in living animals, opened about three hours after a full meal, especially of milk. This is a very troublesome way, and very often hinders us from seeing a great part of this beautiful phenomenon. It is much easier and better to kill the animal about an hour after it has filled its belly, or sooner, if the food be liquid; and this is the method which I have always used with success in my private courses.

222. The lacteal vessels of the third class, or those that lie between the mesenteric glands and middle adhesion of the mesocolon to the spina dorsa run down on the body of the inferior aorta, between the extremities of the small muscle of the diaphragm, and terminate in a kind of cistern called by some *receptaculum chyli*, by others *receptaculum Pecqueti*, from M. Pecquet, a physician at Dieppe in Normandy, who first demonstrated, by incontestible experiments, this receptacle, which had been long before discovered by Eustachius.

*Receptaculum chyli.*

223. The greatest part of the *receptaculum chyli* lies behind the right portion of the inferior muscle of the diaphragm, on the right side of the aorta, at the union of the last vertebra of the back with the first of the loins. It is a kind of membranous vesicle, the conformation of which is various in human subjects. Sometimes it is of an uniform long oval figure, like the *vesicula fellea*; sometimes it is divided by strictures, into several small roundish bags more or less flattened, and sometimes it surrounds the trunk of the aorta like a collar.

224. It is composed of very thin coats, and its cavity is divided by small pelliculæ or membranous septa, the disposition of which is irregular, It is chiefly round the lower part of

this receptacle, that the last lacteal vessels are inserted, some on the sides, and some behind the aorta; and they are accompanied by numerous lymphatic vessels, of which in another place. The upper portion is contracted between the aorta and vena azygos, and forms a particular canal, which runs up through the thorax by the name of *ductus thoracicus*, which shall be described in the next section.

§ 11. *The blood-vessels and nerves of the intestines.*

225. The duodenum has commonly a particular artery called *duodenalis* or *intestinalis*, which comes indifferently from the *stomachica coronaria*, *pylorica*, *gastrica major* or *hepatica*. It has likewise several distinct ramifications from these trunks, and from the *mesenterica superior* and *splenica*, which ramifications communicate with each other.

226. The *arteria duodenalis*, and the other additional small arteries, form a vascular net-work round the muscular coat of the intestine, which sends out a great number of capillaries towards both the outer and inner sides, that make the whole intestine look of a red colour.

227. The veins of the duodenum are *ramæ* of the *vena portæ*, and the distribution and denomination thereof is pretty much the same with that of the arteries; only they communicate more with each other, than the arteries, and also with the great hæmorrhoidal vein.

228. The venal ramifications form round the duodenum a net-work like that of the arteries; and the same kind of vascular texture is more or less to be found in all the other intestines.

229. The arteries of the jejunum come chiefly from the *mesenterica superior*; and some, from the ascending branch of the *mesenterica inferior*. The veins are for the most part branches of the great *mesaraica*; and the rest come from the *splenica* and small *mesaraica* or *hæmorrhoidalis interna*.

230. The principal subaltern trunks of these arteries and veins accompany each other through the cellular substance between the *laminæ* of the mesentery, are distributed by branches and rami, and form the meshes, lozenges, and arches mentioned in the description of the arteries and veins. The last

last of these arches and lozenges, or those next to the intestine produce two small vascular planes, which separate from each other very distinctly, and surround the intestinal canal in a reticular manner.

231. The blood-vessels of the ileum come from the same sources with those of the jejunum, as has been said in the history of the arteries and veins; and it ought to be observed concerning both these vessels, and those of the jejunum, that, in their whole course through the mesentery, they give ramifications to the glands, laminae, and cellular substance of the mesentery; and also that there is a kind of communication between several small mesaraic veins, and the capillary rami of the venae lumbares and spermaticae.

232. The arteries of the caecum and appendicula vermiformis are ramifications of the last branch from the convex side of the mesenterica superior; and they have likewise some small ones from the second and third branches, when both are found. The veins of these two parts are ramifications of the great mesaraica, and one of these rami is by Riolan termed *vena caecalis*.

233. The straight portion of the arch of the colon, or that which is an immediate continuation of the caecum, is supplied with arteries by the second branch that comes from the concave side of the mesenterica superior, and likewise a little by the third, when there is a third.

234. The superior or middle portion of the arch of the colon, is furnished by the first branch from the same side of the mesenterica superior, which by a bifurcation communicates on both hands with the other portions of the arch of the colon.

235. The left portion of this arch derives its arteries partly from the first branch of the same mesenterica, and partly from that of the mesenterica inferior, which two branches form the celebrated communication or common arch of the two mesentericae.

236. By means of this communication or continuation, in case one artery should be obstructed or compressed, the other would furnish blood to all the branches below the place of the obstruction. The second branch of the mesenterica inferior gives likewise small arteries to the left extremity of the colon.

237. The descending convolutions of the colon, which re-



present a Roman S, are supplied by the other branches of the mesenterica inferior, the last of which forms the hæmorrhoidalis interna.

238. The veins of all these portions of the colon are branches and ramifications of the vena portæ ventralis, and principally of the subaltern trunks, the mesaraica major, and mesaraica minor or hæmorrhoidalis interna. The distribution of these branches and ramifications is in some measure the same with that of the arteries, as may be seen in the description of the veins.

239. The arteries of the rectum are furnished by the hæmorrhoidalis interna, the last branch of the mesenterica inferior, which communicates with the hypogastrica, and particularly with the hæmorrhoidalis externa, a production of one of these arteries.

240. The veins of the rectum are ramifications of the last branches of the mesaraica minor or hæmorrhoidalis interna, and they communicate with the hæmorrhoidales externæ, which are rami of one of the hypogastricæ. They communicate likewise with the capillary ramifications of the other hypogastric veins, which go to the internal parts of generation of both sexes.

241. It is here to be observed in general, that there is a successive continuation, more or less simple or multiplied between all the arteries of the intestinal canal, and likewise between all the veins; and also that the veins are here thinner and more capacious than the arteries in a greater proportion than in the other parts of the body.

*Nerves of the intestines.* 242. The nerves of the duodenum are the middle plexus of the semilunar ganglion, and some filaments of the plexus stomachicus and hepaticus.

243. The nerves of the jejunum, ileum, and mesenteric glands, are the plexus mesentericus superior, the posterior mesenteric fasciculi, and the plexus mesentericus inferior.

244. The nerves of the cæcum are the posterior mesenteric fasciculi or plexus, and the plexus mesentericus inferior.

245. The nerves of the arch of the colon are the same fasciculi, and the two plexus mesenterici.

246. The nerves of the last convolutions of the colon are the

the posterior mesenteric fasciculi, and the plexus mesentericus inferior, and sub-mesentericus.

247. The nerves of the rectum are the plexus mesentericus inferior, plexus sub-mesentericus or hypogastricus, and the two ganglions of that plexus.

248. The nerves of the anus, and of its muscles are the ganglions of the plexus sub-mesentericus, the inferior rope of both sympathetici maximi, and the common arch of the extremities of both ropes.

249. Before I proceed to the liver, it must be remarked that the omentum and appendices adiposæ have so near a relation to the liver and spleen, that it is impossible to describe them without mentioning several things belonging to these two viscera; and therefore I think it more proper to give the history of these, after that of the other two, and even of the pancreas, than to begin the history of the parts contained in the cavity of the abdomen by that of the omentum, as is commonly done.

250. For the same reason, I shall not give the uses of these parts, till after they have been all explained; and, together with these uses, I shall speak to those of the intestinal canal, mesentery, vasa lactea, mesenteric glands, muscles of the anus, &c.

## § 12. *Hepar & vesicula fellea.*

251. The liver is a large and pretty solid mass, of a dark red colour, a little inclined to yellow, situated immediately under the arch of the diaphragm, partly in the right hypochondrium, which it fills almost entirely, and partly in the epigastrium, between the appendix ensiformis and spina dorsi, and terminating commonly in the left hypochondrium, into which it sometimes runs a considerable way.

*Situation, figure, and division, of the liver.*

252. The figure of the liver is irregular, it being arched or convex on the upper part, unequally concave on the lower, and very thick on the right and back sides. Towards the left and anterior sides its thickness decreases very much, and terminates there by a kind of edge; and it is broader from right to left, than from before backwards.

253. The liver may be divided into two extremities, one great,

great, the other small; two edges, one anterior, and one posterior; two sides, one superior and convex, which is smooth, polished, and proportioned to the arch of the diaphragm, and one inferior, concave and uneven, with several eminences and depressions, of which hereafter.

254. It may likewise be divided into two lateral parts, called *lobes*; one of which is termed the *great* or *right lobe*, the other, the *small* or *left lobe*. These two lobes are distinguished above, by a membranous ligament; and below very plainly, by a considerable scissure lying in the same direction with the superior ligament.

255. The eminences on the concave side of the liver belong to the great lobe. The principal eminence is a sort of triangular or pyramidal apophysis situated backward near the great scissure which distinguishes the two lobes.

256. This triangular eminence is termed *lobulus Spigelii*, or simply the small lobe of the liver. One of its angles advances a considerable way toward the middle of the lower side of the great lobe, and is lost there. This angle I call the root of the lobulus. Toward the fore side, there is another eminence less prominent, but broader; and to this eminence and the former, the ancients gave the general name of *portæ*.

257. The depressions on the concave or lower side of the liver, which deserve our attention, are four in number. The first is the scissure that separates the two lobes, which runs across the concave side, from the eminences already mentioned to the anterior edge, where it terminates by a notch of different depths in different subjects. This is termed the great scissure of the liver, and in some subjects part of it is an entire tube.

258. The second depression is situated transversely between the two eminences of the great lobe, and filled by the sinus of the vena *portæ*, so called by the ancients, because it lies between the eminences of the same name. The third depression is backward, between the great lobe and lobulus Spigelii, and the vena cava passes through it. The fourth is a kind of sulcus between the lobulus and small lobe of the liver, which in the foetus served to receive a venal canal lost in adults, in whom it appears only as a kind of ligament. This sulcus is in some measure a continuation of the great scissure, and joins the vena cava by an acute angle.

259. Besides



259. Besides these four depressions, there is one on the fore-part of the great lobe, in which the vesicula fellis is lodged, and it sometimes runs as far as the edge, where it forms a small notch. We may likewise reckon among these depressions, a small superficial cavity in the posterior and lateral part of the lower side of the great lobe, by which it rests on the right kidney; and likewise a superficial cavity in the left lobe, where it runs over the stomach.

260. Lastly, on the posterior edge of the liver, there is a great sinus common to both lobes, which gives passage to the spina dorsii and œsophagus, near the place where the vena cava descends; and we sometimes meet with scissures on both sides of the liver, which are not ordinary.

261. The convex side of the liver is commonly connected to the diaphragm by three ligaments, which are only continuations of the membranous lamina of the peritonæum. One lies near the edge of the extremity of each lobe, and one in the middle, and they are accordingly termed the *right, middle, and left ligaments*. There is a cellular substance in the duplicature of each, in which the blood-vessels and lymphatics run, and which sends off a kind of lamina into the substance of the liver.

*Ligaments of  
the liver.*

262. The right ligament sometimes connects the great lobe to the cartilages of the false ribs, and the left ligament, or that of the small lobe, is often double, and advances toward the middle ligament. This middle ligament begins below, in the great scissure of the liver, near the eminences called *portæ*, and from thence passes through the anterior notch, and over the convex side of the liver at the union of the two lobes, and is fixed obliquely in the diaphragm.

263. It is likewise fixed along the upper and inner part of the vagina of the right musculus rectus of the abdomen, in such an oblique manner as to be nearer the linea alba below than above.

264. Besides these ligaments, the great lobe of the liver is likewise connected to the right ala of the tendinous portion of the diaphragm, not by a ligament, but by a broad and immediate adhesion, without the intervention of the membrane of the peritonæum, which is only folded quite round this adhesion, to form the external membrane of all the rest of the body of the liver.

265. This

265. This broad adhesion is commonly though improperly called *ligamentum coronarium*; but in the first place it is not a ligament, as has been already observed, and, secondly, it is not circular, but oval and very oblong.

266. It is not on the upper part of the convex side of the liver, but along the posterior part of the great lobe, the broad extremity of the adhesion lying nearer the notch, and the pointed extremity towards the right hypochondrium.

267. The middle ligament, called improperly *ligamentum hepatis suspensorium*, contains in its duplicature a thick white rope, like a round ligament, which was the umbilical vein in the fœtus. Thus the lower part represents a falx, the convex edge of which is sharp, and the other rounded.

268. All these ligaments serve to keep the liver in its proper situation, and to hinder it from inclining too much towards either side: but we must not imagine that any of them serve to suspend it; because it is sufficiently supported by the stomach and intestines, especially when they are filled.

269. When the stomach is empty, or when we fast longer than ordinary, it is a common expression to say the stomach pinches us. As the liver is not then sustained by the stomach and intestines, it descends by its own weight, and chiefly by means of the middle ligament pulls the diaphragm along with it. It is in that place therefore that we have this uneasy sensation, and not at the superior orifice of the stomach, as is commonly believed.

270. The right or great lobe of the liver which lies in the right hypochondrium, rests on the right kidney, by a small superficial depression above-mentioned; and it likewise covers a portion of the arch of the colon and the pylorus. About two third parts of the small or left lobe lie in the middle of the epigastrium, and the remaining third part advances over the stomach, towards the left hypochondrium.

271. This small lobe is situated almost horizontally; the great lobe is very much inclined, and its thick extremity runs down almost in a perpendicular direction to the right kidney on which it lies, in the manner already said. This observation is of use to distinguish the different parts of the liver in wounds and chirurgical operations.

272. It may likewise serve to direct us in examining a liver taken out of the body; the situation of which may be otherwise

wife very easily mistaken, especially that of the parts of the concave side. The passage of the vena cava, between the body of the great lobe and the lobulus Spigelii, may likewise serve for a rule in placing a detached liver in its true situation.

273. The liver is composed of several kinds of vessels, the ramifications of which are multiplied in an astonishing manner, and form, by the intertexture of their capillary extremities, an innumerable collection of small pulpy, friable corpuscles, which are looked upon to be so many organs designed to separate from the mass of blood a particular fluid termed the *bile*.

*Structure of the liver.*

274. The greatest part of these vessels from one end to the other is included in a membranous vagina called *capsula venæ portæ*, or *capsula Glissoni*, from an English author who first described it particularly.

275. The vessel which carries the blood to the liver is called *vena portæ*, for the reason already given. In the description of the veins, I observed that the vena portæ might be considered as two large veins, the trunks of which are joined endwise, and send out branches and ramifications in opposite directions to each other; that one of these veins is ramified in the liver, the other lying without the liver, and sending its branches and ramifications to the viscera of the abdomen; and, lastly, that the first of these large veins may be termed *vena portæ hepatica*, the other *vena portæ ventralis*.

276. The particular trunk of the vena portæ hepatica is situated transversely between the broad anterior eminence of the great lobe of the liver, and the root of the lobulus, in a particular scissure, and forms what is called the *sinus of the vena portæ*. From this sinus five principal branches go out, which are afterwards divided into millions of ramifications through the whole substance of the liver.

*Vena portæ hepatica.*

277. At this place the vena portæ lays down the common office of a vein, and becomes a kind of artery as it enters, and is again ramified in the liver. The extremities of all these ramifications of the trunk of the vena portæ hepatica end in the pulpy friable corpuscles which seem to be thick villous folliculi, when examined through a microscope in clear water.

278. It is in these folliculi that the bile is secreted, and it is



*Pori bilarii et ductus hepaticus.*

immediately collected in the same number of extremities of another kind of vessels, which unite, by numerous ramifications into one common trunk. These ramifications are termed *pori bilarii*, and the trunk, *ductus hepaticus*; and the ramifications of these two kinds of vessels are invested together by the capsula of the vena portæ

279. The blood deprived of this bilious fluid is reconveyed to the heart by a great number of venal ramifications, which afterwards unite into three principal branches, besides others that are less considerable, that terminate in the vena cava, and are all called by the name of *vena hepatica*.

280. The capillary extremities of the ramifications of the vena cava, join those of the vena portæ, and accompany them through the liver; and yet the great branches of both veins intersect each other in several places.

281. When we cut the liver in slices, it is easy to distinguish in each slice, the ramifications of the vena cava from those of the vena portæ, the first being thinnest and largest, and adhering closest to the substance of the liver; whereas those of the vena portæ which are invested by the cellular capsula, appear to be a little ruffled when empty; because the cellular capsula subsides, when it is cut, but the other veins remain uniformly open, their sides adhering to the substance of the liver.

282. The liver receives from the arteria cæliaca a particular branch termed *arteria hepatica*, which being very small, when compared with the bulk of that viscus, seems designed only for the nourishment thereof, and not for the secretion of the bile. The plexus hepaticus formed by the nervi sympathetici maximi et medii, furnishes a great number of nerves to the substance of the liver. The ramifications of the artery and nervous plexus are included in the cellular capsula, together with those of the vena portæ and pori bilarii.

283. The pulsation of this artery has been by some anatomists taken for that of the capsula, and by this they have endeavoured to explain the arterial function of the vena portæ; but they have not considered that the blood in this vein does not require to be pumped forward; because so swift a motion would

would have been prejudicial to the secretion of the fine oil of the bile, for which a slow and almost insensible motion is necessary.

284. The liver is covered exteriorly by a particular membrane or coat, which is a continuation of the peritonæum. There is likewise a membranous or filamentary substance that runs through this whole viscus, and connects the ramifications and extremities of all its vessels to each other. This substance seems to be a complicated production of the capsula of the vena portæ, and of the external membrane of the liver.

285. The outer surface of this coat is very smooth, but its inner surface is uneven, being made up of a great number of thin membranous laminae, between which we observe very distinctly, numerous lymphatic vessels, on both the convex and concave sides of the liver; but it is more difficult to trace those which accompany the filamentary substance through that viscus.

286. I have already observed that the substance of the liver is chiefly made up of an infinite number of pulpy friable corpuscles, each of which is bounded and in a manner surrounded by a particular expansion of the capsula Glissoni, and all these expansions are connected by common septa, in some measure resembling a bee-hive.

287. These corpuscles have several angles especially in the inner surface of the liver; but near the surface they are raised in the form of small tubercles. Their pulpy texture appears like radiated villi, a small void space being left in the middle of each.

288. If we blow through a pipe into the vena portæ, vena cava, arteria hepatica, or trunk of the pori bilarii, but especially through the two veins, we observe the liver to swell, and the corpuscles near the surface are raised, and become more sensible. If we blow with much force we burst these corpuscles, and the air getting between them and the external membrane, raises it from the substance of the liver in blisters.

289. The ductus hepaticus, or trunk of the pori bilarii, having run a little way joins another canal *Ductus cholidochus*, called *ductus cysticus* or *vesicularis*, because it comes from the vesicula fellea, as we shall see in the descrip-

tion of that organ. These two united ducts form a common trunk, named *ductus cholidochus*, because it conveys the bile. This duct having reached the incurvation of the duodenum, insinuates itself through the coats of that intestine, and opens into the cavity thereof, not by a round papilla, but by an oblong orifice rounded at the upper part, and contracted at the lower, like the spout of an ewer, or like a common tooth-picker.

290. The edges of this orifice are raised, broad, and plaited, as we may see by making this portion of the duodenum swim in clear water. At the entry of this orifice we see another smaller opening distinct from it, which is the orifice of the *ductus pancreaticus*, of which hereafter.

291. The gall-bladder is a kind of small bag shaped like a *Vesicula felleis*, pear, that is, narrow at one end and wide at the other. The wide extremity is termed the *fundus* or *bottom*, the narrow extremity the *neck*, and the middle portion, the *body*. About one third of the body of the vesicula lies in a depression on the concave side of the liver, from the trunk or sinus of the *vena portæ*, where the neck is situated, to the anterior edge of the great lobe, a little toward the right side, where the bottom is placed, and in some subjects it advances beyond the edge.

292. Therefore when we stand, the *vesicula felleis* lies in a plane inclined a little from behind forward. When we lie upon the back, it is almost inverted. When we lie on the right side, the bottom is turned downward; and it is turned upward when we lie on the left side; and these situations vary according to the different degrees of each posture.

293. The gall-bladder is composed of several coats; the outermost of which is a continuation of that which invests the liver, and consequently of the peritoneum.

294. The second coat is fleshy, and made up of two strata, one longitudinal, the other transverse, the fibres of which have nearly the same irregular direction with those of the stomach; and this disposition of the fibres in these viscera is owing to the different diameters in the several portions of them, and to their incurvation.

295. These two coats are connected by a cellular substance continued between the body of the vesicula and the liver, all the way to a whitish stratum, which is looked upon as the third

coat



coat of the gall-bladder, answering to the tunica nervosa of the intestines.

296. The innermost or fourth coat has on the inside a great number of reticular folds, filled with small lacunæ, like perforated papillæ, especially near the neck of the vesicula, where these folds are longitudinal, and afterwards form a kind of small pylorus with plaits of the same nature with those in the great one. These lacunæ are looked upon to be glands.

297. That side of the body of the vesicula which lies next the liver is connected to that viscus by a vast number of filaments, which run a great way into the substance of the liver; and among these filaments there are some ducts which form a communication between the pori bilarii and vesicula. These ducts have been observed in brutes a long time ago, and they have been very lately discovered in men likewise. They are most numerous near the neck of the vesicula, and they are named *ductus cysto-hepatici*, or *hepatico-cystici*.

298. The neck of the vesicula is formed by the contraction of the small extremity; and this neck bending afterwards in a particular manner, produces a narrow canal named *ductus cysticus*. This incurvation represents in some measure the head of a bird, of which the cystic duct, by the gradual diminution of its diameter, expresses the beak. This cannot be seen when the liver is extra situm; and even in situ it is but very imperfectly seen, when, in order to view the concave side, the liver is raised and thrust too much against the diaphragm; for, by thus inverting the liver, the curvature is disordered, and we see two in the place of one.

299. To see this curvature in its true natural situation, the liver is to be raised but very little, and the duodenum left untouched; then we must stoop and look under the liver without disordering any thing. This incurvation may be of use to hinder too precipitate a discharge of the bile contained in the vesicula, which some situations of the body might occasion.

300. The neck of the vesicula is nearly of the same structure with the other parts. It has on the inside several reticular rugæ and some folds which appear like fragments of valvulæ conniventes, situated very near each other, from the neck to the contraction of the cystic duct. The first of these folds is pretty broad and large, and almost circular; the next

is

is more oblique and smaller in size, and the rest diminish in the same manner. Taken all together, they form a kind of spiral flight, which may be seen through the neck on the outside, where it sometimes appears like a screw, especially when the neck is filled with any fluid. This observation is owing to M. Heister.

301. By flitting the neck and duct we see all these folds very distinctly, especially when we examine them in clear water. When they are viewed in any other manner, they easily deceive us, being mistaken for true valves because of their transverse situation. They may however, in some measure, supply the place of valves by hindering the bile from running too fast into the duodenum, and the contents of the duodenum from entering this duct.

302. The internal surface of all these biliary ducts, that is, of the ductus hepaticus, cysticus, and cholidochus, being examined through a microscope in clear water, appears to be nearly of the same structure, through their whole extent.

303. The cystic and hepatic ducts do not in their ordinary and natural situation represent the capital Y of the Greeks, where they form the ductus cholidochus. After the incurvation of the neck of the vesicula, these two ducts run very near each other, and they appear to be separated, only by raising up the liver to view them. The same disorder happens in an inverted liver extra situm; for then the body of the liver subsides, and is flattened, and thereby separates the ducts; whereas, in its true situation, it is very much incurvated, and the ducts very near each other.

304. The ductus cholidochus appears rather to be a continuation of the ductus cysticus, than the common trunk of that and of the ductus hepaticus; for I have observed that this last duct runs for some space within the sides of the former, before it opens into the cavity, much in the same manner as the ductus cholidochus passes into the duodenum. I have likewise observed, at the opening of the hepatic into the cystic duct, a small loose valvular membrane, which may hinder the bile from returning out of the ductus cholidochus into the hepaticus.

305. The bile which passes through the ductus hepaticus into the cholidochus, may be called *hepatic*; and that which is collected in the vesicula fellea, may be termed *cystic*. The hepatic bile

bile flows continually through the ductus cholidochus into the duodenum, whereas the cystic bile flows only by reason of plenitude or by compression.

306. The trunk of the vena portæ ventralis terminates between the lobulus and the opposite part of the great lobe; and there joins the trunk of the vena portæ hepatica in the transverse sinus of the liver, between the right extremity, and the middle of that sinus.

*Remarks on the vessels. &c. of the liver.*

307. The umbilical ligament, and consequently the umbilical vein in the foetus joins the trunk of the vena portæ hepatica, toward the left extremity of the transverse sinus of the liver. The canalis venosus in man is not exactly opposite to the vena umbilicalis, but a little to the right hand, and therefore these three vessels lie in such a direction as to form two opposite angles, resembling those of the handle of a wheel or of a spit.

308. In the foetus, therefore, the blood which comes from the umbilical vein does not run directly through that contained in the vena portæ hepatica in the sinus, and from thence into the canalis venosus; but is obliged to turn from left to right, and so to mix with the blood in the vena portæ, before it enters that canal which opens into the trunk of one of the great hepatic veins of the vena cava near the diaphragm.

309. The hepatic vena portæ gives off commonly five large branches into the liver, viz. three from its right extremity into the great lobe, and two from its left extremity into the small lobe, and from the interstice between these, a small branch goes directly to the middle of the convex side of the liver.

310. The hepatic veins are commonly three large branches of the trunk of the vena cava inferior, which go out from it by one common opening, especially two of them, and then separating, they enter the substance of the liver, intersecting the branches of the hepatic vena portæ, and are ramified in all directions in the manner already explained. The inferior portion of the opening of these veins into the vena cava, forms a kind of semilunar valve.

311. Below these hepatic veins, the vena cava inferior sends off, in its passage by the liver, several other small hepatic veins immediately from the trunk, which seem to have the same



same relation to the hepatic artery as the great veins to the vena portæ.

312. The passage of the vena cava is through the right portion of the posterior sinus of the liver, and consequently on the side of the great lobe, which is hollowed at this place sufficiently to give passage to the vein, of which it surrounds about three fourths, sometimes more, and sometimes the whole.

313. This passage answers to the interstice between the lobulus and the rest of the great lobe; and its direction is in the natural state from above downward, and a little from right to left: But when the liver is viewed extra situm, and inverted, it appears very oblique; but still it serves as a guide to beginners, who are very apt to be mistaken in examining an inverted liver, as I have already observed.

314. The trunk of the great vena portæ, the hepatic arteries, the ductus hepaticus, or trunk of the pori bilarii, and the nerves of the plexus hepaticus, form all together a large bundle, before they enter the liver. The trunk of the hepatic vena portæ is in the middle of this bundle, the hepatic arteries lie on the right and left sides of this trunk, the nerves surround it on all sides, and they communicate with the plexus mesentericus superior.

315. Afterwards the first branches of the arteries, nerves, and pori bilarii leave the trunk of the great vein, and join in the same manner, the trunk of the small or hepatic vena portæ, and its ramifications in the capsula Glissoni explained above.

316. All these branches of the vena portæ, and of the arteries, nerves, and pori bilarii, accompany each other by ramifications through the whole substance of the liver, forming every where small fasciculi in the same manner as the large bundles is formed by their trunks. Each ramus of the vena portæ, artery, nerve, and porus bilarius has a proper vagina, and all the four have a common vagina distinguished from the former cellular septa, which are only continuations of the vaginæ of both kinds.

317. The convex side of the common cellular vagina is connected quite round, to the substance of the liver by numerous filaments which arise from it, and which form the cellular substance

substance found between the glandular corpuscles. The concave side produces the cellular septa above mentioned.

318. In this common vagina, the vessels, ducts, and nerves are disposed in such a manner, as that the rami of the vena portæ chiefly fill the cavity of it, and is in a lateral situation; the arterial ramus and porus bilarius lie together on the side of the vein, and the nerve is divided into several filaments, which run in between the vessels and ducts, and chiefly accompany the artery and porus bilarius; the vena porte having by much the fewest.

319. The uses of the liver shall be explained after the description of the pancreas, spleen, and omentum, all these viscera having a great relation to the liver.

### § 13. *Pancreas.*

320. The pancreas is a long flat gland, of that kind which anatomists call conglomerate, situated under the stomach, between the liver and the spleen. Its figure resembles that of a dog's tongue, and it is divided into two sides, one superior, the other inferior; two edges, one anterior, the other posterior; and two extremities, one large, which represents the basis of a tongue, and one small, and a little rounded like the point of a tongue.

*Figure, division, and situation of the pancreas.*

321. The pancreas is situated transversely under the stomach, in the duplicature of the posterior portion of the mesocolon. The large extremity is connected to the first incurvation of the duodenum, and from thence it passes before the rest of that intestine, all the way to its last incurvation; so that a great part of the duodenum lies between the pancreas and the vertebræ of the back. The small extremity is fixed to the omentum near the spleen.

322. The pancreas is composed of a great number of soft glandular molecule, combined in such a manner, as to exhibit the appearance of one uniform mass on the outside, the surface of which is rendered uneven, only by numerous small convexities, more or less flattened. When these molecule are separated a little from each other, we find, along the middle of the breadth of the

*Structure of the pancreas.*

pancreas, a particular duct, in which several smaller ducts terminate laterally on each side, like small rami in a stem.

323. This canal, named *ductus pancreaticus* or *ductus Virsungi*, from the discoverer of it in the human body, is very thin, white, and almost transparent, and the extremity of the trunk opens commonly into the extremity of the *ductus cholidochus*. From thence it diminishes gradually, and terminates in a point, next the spleen. The small lateral branches are likewise pretty large near the trunk, and very small toward the edges of the pancreas, all of them lying in the same plane like the branches of the common filix or fern.

324. The pancreatic duct is sometimes double in man, one lying above the other. It is not always of an equal length, and sometimes runs in a winding course, but always in the same plane; and it is nearer the lower than the upper side of the pancreas. It pierces the coats of the duodenum, and opens into the *ductus cholidochus*, commonly a little above the prominent point of the orifice of that canal; and sometimes it opens immediately into the duodenum.

325. In man, I observed several years ago, that where the great extremity of the pancreas is connected to the curvature of the duodenum, it sends down an elongation, which adheres very closely to the following portion of the intestine; and, upon a careful examination, I found a particular pancreatic duct ramified like the large one, which ran toward and intersected this great duct, into the extremity of which it opened, after having perforated the duodenum. This portion I term *pancreas minus*, and it sometimes opens separately into the duodenum, in which we likewise observe several small holes round the *ductus cholidochus*, which answer to the pancreas.

326. The arteries of the pancreas come from the pylorica, duodenalis, and chiefly from the splenica, which adheres very closely to the whole lower side of the pancreas near the posterior edge, and it sends off in its passage a great many rami named *arteriæ pancreaticæ*, which go off from each side, more or less transversely. It receives also some small ramifications from the *gastrica major*, and *mesenterica superior*.

327. The pancreatic veins are rami of the splenica, one of the principal branches of the *vena portæ major* or *ventralis*.

This



This vena splenica runs likewise along the lower side of the pancreas near the edge, in a shallow depression formed in the substance of the gland. These veins answer to the arteries of the same name, and there are likewise other small veins corresponding to the small arteries, which are productions of the great mesaraica, &c.

328. The nerves of the pancreas come partly from the plexus hepaticus, partly from the plexus splenicus, and partly from the plexus mesentericus superior, and it likewise receives some from the flat ganglion or plexiform intertexture, spoken to in the description of the nerves, N<sup>o</sup> 413. and mentioned by the name of the *transverse rope*, N<sup>o</sup> 140.

329. The pancreatic duct is not only double in some subjects, as has been said, but the collateral branches have communications in form of islands in several places, within the body of the pancreas. The uses of this viscus shall be explained hereafter.

#### § 14. *Lien.*

330. The spleen is a bluish mass, something inclined to red, and of a long oval figure, being about seven or eight fingers breadth in length, and four or five in breadth. It is of a softish substance, and is situated in the left hypochondrium, between the great extremity of the stomach, and the neighbouring false ribs, under the edge of the diaphragm, and above the left kidney.

*Situation, division, and figure of the spleen.*

331. It may be naturally divided into sides, edges, and extremities, as I have always done in my ordinary courses, for these many years past. It has two sides, one external and gently convex, and one internal, which is irregularly concave; two extremities, one posterior, which is pretty large, and one anterior, which is smaller and more depressed; two edges, one superior, and one inferior, on both which there are, in some subjects, several inequalities.

332. The inner or concave side is divided by a longitudinal groove or scissure, into two planes or half sides, one upper, the other lower; and, by this groove, the vessels and nerves enter in human subjects. The superior half side is broader and more concave than the inferior, being proportioned to

the convexity of the great extremity of the stomach. The inferior half side lies backward on the left kidney, and forward on the colon; and sometimes this side of the spleen appears to have two superficial cavities, one answering to the convexity of the stomach, the other to that of the colon. The convex side of the spleen is turned to the left ribs

333. It is connected to the stomach by the vessels called *vasa brevia*; to the extremity of the pancreas by ramifications of the splenic artery, and vein, and to the omentum by ramifications which the same artery and vein send to the spleen, and which run in the longitudinal groove.

334. It is connected to the edge of the diaphragm by a particular membranous ligament of different breadths in different subjects, fixed in its convex side, sometimes near the upper edge, and sometimes near the lower. This ligament is situated transversely with respect to the whole body, and longitudinally with respect to the size of the spleen. In some subjects, it is connected by other ligaments to the stomach and colon, but in all this there are considerable varieties.

335. The figure of the spleen is not always regular, and is as various as the size. Sometimes it has considerable scissures both in the sides and edges, and sometimes it has appendices. I have sometimes found a kind of small distinct spleens, more or less round, and connected separately to the omentum, at some distance from the anterior extremity of the ordinary spleen.

336. The structure of the spleen is not easy to be unfolded in man, and it is very different from that of the spleens of brutes, from which both public and private demonstrations are commonly made.

337. Its coverings adhere to it so closely in man, that it is difficult to distinguish the common from the proper coat; whereas in some brutes, such as oxen, sheep, &c. nothing is more easy; for in such animals we find two coats separated by a cellular substance. This covering seems to be no otherwise a continuation of the peritonæum than by the intervention of the omentum and mesocolon; and even in man the two coats may be distinguished, where the vessels enter by the longitudinal scissure.

338. In man the substance of the spleen is almost wholly valcular, that is, composed of the ramifications of all kinds of

of vessels. In oxen the substance of the spleen is chiefly reticular, and in sheep it is cellular. In oxen and sheep there are no venal ramifications, but instead thereof only open sinuses disposed like branches, except a small portion of a venal trunk perforated on all sides, at the extremity of the spleen.

339. In the human spleen we see something like glandular corpuscles, as in those of other animals; and there are numerous venal ramifications through its whole extent. Between these ramifications we every where observe an appearance of extravasated blood, lying in a kind of filamentary transparent and very delicate substance expanded through the whole spleen.

340. This filamentary substance having surrounded all the ramifications, terminates in almost imperceptible cells which communicate with each other; so that if we blow through a small hole made in the membranous covering, the whole spleen will immediately be inflated.

341. The surface of the spleen of oxen and calves is visibly full of a great number of lymphatic vessels, which may at any time be easily demonstrated; but in man it is a very difficult matter either to discover or demonstrate them.

342. The splenic artery, which is one of the principal branches of the cæliaca, runs along the lower side of the pancreas, as has been already said, and passes from thence in a winding course to the spleen. *Blood-vessels and nerves of the spleen.*

The splenic vein, which is larger than the artery, is but little inflected in this part of its course.

343. This artery and vein having got beyond the extremity of the pancreas, send out several rami together, which immediately afterwards devaricate in the same plane, run in the membranous duplicature of the neighbouring portion of the omentum, and lastly intersect each other in their common plane, all the way to the scissure of the inner or concave side of the spleen.

344. These arterial and venal rami enter the substance of the spleen together by the same scissure; being accompanied by the cellular substance belonging to the membranous duplicature of the omentum. We may likewise observe, that at this place the coat of the spleen sends from its concave side, a portion of the lamina, which is incurvated in the scissure, and penetrates into the substance of the spleen.

345. The



345. The nerves of the spleen are very numerous, and come from the plexus splenicus, already described. These nerves send out, at different distances, round all the arterial ramifications of the substance of the spleen, a great number of filaments in form of an irregular net-work.

346. The arteries, veins, and nerves having entered the spleen, are there divided and subdivided into a great number of ramifications, and accompany each other to the very last extremities of their divisions. They are contained in a kind of common cellular capsula or vagina, which first surrounds all the three, and then sends off particular septa between them. This capsula seems to be formed by a continuation of the cellular substance of the omentum, and of that particular lamina of the coat of the spleen which I mentioned above.

347. The capillary extremities of all these vascular ramifications, both arterial and venal, end in the filamentary cells already mentioned. Malpighi considered them as distinct capsulæ or folliculi, containing the same number of small glands. They all communicate together, so that where-ever we pierce the coat of the spleen, we may, through that hole, inflate the whole viscus.

348. In oxen and sheep, there are no venal ramifications, as I have said. The vena splenica having entered the great extremity of these spleens, runs first of all for about half an inch or an inch, and afterwards instead of an ordinary vein we find a canal perforated on all sides. The beginning of this canal has still some remains of the coats of a vein; but the form of it is soon lost, and then we find nothing but sinuses or sulci in the reticular substance in oxen, and in the cellular substance in sheep.

349. The splenic artery and nerves are there ramified in a particular vagina, as in men; and the extremities of these arterial ramifications seem to swim or float in the cells, and to fill their filamentary substance with blood. At the ends of several of these capillaries, I have observed small corpuscles disposed like bunches of grapes; and I have seen two small tubes going out from each corpuscle, one long and open, the other small and short, which was lost in the sides of the spleen.

350. I imagine that the long tube, the extremity of which

I was not able to find, may be the origin of a lymphatic vessel, especially because these vessels are so very numerous and visible in an ox's spleen, as has been already said. These small corpuscles may easily be discovered in an ox's spleen, when boiled by a particular administration, of which I shall say more in another place. They are indeed much larger before than after boiling, but they are not so solid, and subside more easily when cut. The same sort of corpuscles may be discovered in the human spleen, but they are so extremely small, as not to be visible without a microscope.

351. The uses of the spleen shall be explained after the description of the omentum.

§ 15. *Omentum & appendices epiploicae.*

352. The omentum is a large, thin, and fine membranous bag, surrounded on all sides by numerous portions of fat which accompany and even invest the same number of arteries and veins adhering closely to each other.

*Situation, division, and connection of the omentum.*

353. The greatest part of it resembles a kind of flat purse or a sportsman's empty pouch, and is spread more or less on all the small intestines from the stomach to the lower part of the regio umbilicalis. Sometimes it goes down to the lower part of the hypogastrium, and sometimes does not reach beyond the regio epigastrica. It is commonly plaited or folded in several places, especially between the bands of fat.

354. It is divided into a superior and inferior; an anterior and posterior, and a right and left portion. The superior portion is in a manner divided into two borders, one of which is fixed along the great curvature or convex side of the arch of the colon, and the other along the great curvature of the stomach. The commissure or union of these two borders on the right side, is fixed to the common ligament or adhesion of the duodenum and colon, and to the contiguous parts of these two intestines. That on the left side is fixed to the longitudinal fissure of the spleen, to the extremity of the pancreas, and to the convex side of the great extremity of the stomach. It is likewise fixed to the membranous ligament which sustains the ductus cholidochus, and connects it to the vena portæ ventralis.

335. Be-

355. Below these adhesions, the other portions, that is, the anterior, posterior, two lateral and inferior portions, which last is the bottom of the sacculus epiploicus, have commonly no fixed connections, but lie loose between the fore-side of the cavity of the abdomen and the intestines. The anterior and posterior portions are generally called the *laminae of the omentum*; but as that term is ordinarily employed to express the duplicature of some compound membrane, it would be more convenient to call them *folia, alæ*, or some such name.

356. The membrane of the omentum is, through its whole extent, made up of two extremely thin *laminae* joined by a cellular substance; the quantity of which is very considerable along the blood-vessels, which it every where accompanies in broad bands proportioned to the branches and ramification of these vessels. These cellular bands are more or less filled with fat, according to the corpulency of the subject, and for that reason I have called them *bands or portions of fat*.

357. Besides this large membranous bag, which I name the *great omentum*, there is another much smaller, which differs from the large one, not only in size, but also in figure, situation, and connection; and this I name the *little omentum*. This small bag is fixed by its whole circumference, partly to the small curvature of the stomach, and partly to the concave side of the liver before the sinus of the vena portæ, so as to surround and contain the prominent portion of the lobulus.

358. The little omentum is thinner and more transparent than the other, and its cavity diminishes gradually from the circumference to the bottom, which in some subjects terminates in several small cavities or fossulae more or less pointed. Its structure is pretty much the same with that of the great omentum, it being composed of two *laminae*, with a mixture of the same portions of fat, which are considerably finer than in the other.

359. We see from this situation of the two omenta, that in the space left between the lower side of the stomach, and upper side of the mesocolon, they have a very broad communication with each other; so that if either of them contained in its cavity any fluid, that fluid might readily get between the stomach and mesocolon, and so pass into the other bag; especially



cially when the stomach is empty, and consequently its situation easily changed.

360. Therefore, by means of this interstice between the stomach and mesocolon, the two omenta form one cavity, which opens into the cavity of the abdomen by one common orifice, situated near the commissure on the right side of the great omentum. This orifice is semilunar or semicircular, and formed by the union of two membranous ligaments, whereof one connects the beginning of the duodenum and neck of the vesicula fellis to the liver; the other connects the contiguous portion of the colon to the same viscus and extends to the pancreas. From thence arises an incurvated border, which surrounds the root of the lobulus, leaving an opening wide enough to admit the end of the finger.

361. To discover this orifice of the omentum, we need only raise a little the great lobe of the liver, and find out the root of the lobulus, and apply to it a large pipe wrapped round with cotton, wool, or tow, to hinder the regress of the air. Then if we blow gradually, the air will inflate the sides of the great omentum, and give it the appearance of a large bladder irregularly divided into several lobes or tubercles by the bands of fat, which appear in this state, like so many fræna between the lobes.

362. To be sure of succeeding in this experiment, the two omenta must be in their natural state, and they must be handled very gently with the fingers first dipt in oil. It succeeds better in young, lean subjects, than in old or fat subjects.

363. When we touch these membranes with dry fingers, they stick to them so closely as hardly to be separated without being torn, as we see by the reticular holes which appear in those portions of the membranes that have been thus handled. In that case it is to no purpose, to blow through the natural orifice already mentioned; and it is owing to these small holes that the membranes of the omentum have been supposed to be naturally reticular.

364. The membranous laminae of the little omentum are continuous partly with the external membrane of the liver, partly with that of the stomach, and a little with the membrane that lines the neighbouring portion of the diaphragm. Those of the great omentum are continued partly with the same coat of the stomach, and partly with the external cover-

ing of the colon, and consequently with the mesocolon; and they likewise communicate with the covering of the spleen.

365. We may satisfy ourselves concerning these continuations, by making a small hole in one of the laminæ of the omentum near the stomach, colon, &c. and by blowing into that hole, through a pipe well fitted to it; for the air will gradually insinuate itself under the common coats of these viscera; but if the parts be dry, they must be moistened a little, before the experiment is made.

366. The fatty appendices of the colon and rectum have always appeared to me to be a kind of small omenta or appendices epiploicæ. They are situated at different distances along these intestines, being particular elongations of their common or external coat. They are of the same structure with the great omenta, and their is a cellular substance contained in their duplicature, more or less filled with fat, according as the subject is fat or lean.

367. Next the intestine, each of them forms a broad, thin basis, and they terminate by irregular papillæ, thicker than their bases. These bases are at first disposed longitudinally, then obliquely, and lastly, more or less transversely, especially near the rectum, and upon that intestine.

368. These appendices are for the most part separated from each other; but some of these which have longitudinal bases communicate together, the vestiges of these communications being very narrow, and not very prominent. By blowing through a small hole made in one of these appendices, it is inflated like a small irregular bladder, and the air passes under the external coat of the colon or rectum.

369. Besides these appendices epiploicæ, we observe at different distances along the colon, between the ligamentary band which lies hid, and one of the other two, that is, on both sides of the adhesion of the mesocolon, several adiposæ strata, which may likewise be looked upon as appendices of the same nature with the former, but these strata are very seldom observed between the two apparent ligamentary bands of the colon.

*Vessels of the  
omentum.*

370. The arteries and veins of the great omentum are branches of the gastricæ; and for that reason go by the name of *gastro-epiploicæ*,  
*dextræ*

*dextræ* and *sinistræ*. The arteries on the right side answer to the hepatic artery, and those on the left side to the splenic, and both communicate with the arteria ventriculi coronaria, and respectively with the arteriæ mesentericæ. The gastro-epiploic veins answer, in the same manner of distribution, to the vena portæ.

371. The vessels of the little omentum come chiefly from the coronariæ ventriculi, and those of the appendices and strata are ramifications from the reticular texture of the arteries and veins of the colon and rectum.

§ 16. *Uses of the abdominal viscera described in the thirteen foregoing paragraphs.*

372. The intestines in general finish what the stomach had begun. The alimentary pulp having been sufficiently prepared by the succus gastricus, or lymph of the stomach, undergoes a farther change by the intestinal lymph, bile, and pancreatic juice, by which the milky liquor called *chyle*, is produced, and this liquor rendered fluid enough to enter the lacteal vessels through the tunica villosa of the small intestines, while the grosser portion of the aliment continues its course, and becoming gradually thicker as it advances toward the great intestines, is there collected by the name of *feces*.

373. The dilatation of the intestines is bounded by their common coat. The undulating, successive, and periodical contraction of the fleshy fibres, especially of the orbicular fibres of the muscular coat, expresses the intestinal lymph, beats it up into an emulsion with the alimentary paste, strains that emulsion through the lacteal vessels, and propels the residuum in the manner already said.

374. The nervous coat serves to sustain the tunica villosa, and, by the oblique disposition of its fibres, yields to the periodical motions of the muscular coat, without compressing the chyloferous ducts which pass through the meshes of this coat in the small intestines. The uses of the villous or internal coat are sufficiently apparent from the description given of it.

375. The length of the small intestines gives a great extent to what may be called the *strainer of the chyle*, and this



extent is very much enlarged by the numerous folds termed *valvula conniventes*. By means of this large extent, there is a great quantity of chyle strained through these intestines, and the valves hinder the alimentary pulp from passing through them too fast, that is, before all the milky juice has been expressed; and this may be observed chiefly in the beginning of the intestines, where these valves are most numerous and broadest, and the aliment most fluid.

376. The cavity of the great intestines, serves to receive the fæces of the aliment, and to contain a considerable quantity thereof for a certain space of time, without any inconveniency, and without being obliged to discharge them continually, which would be as great an inconveniency as any. The incurvation of the colon, its cells and contraction of its last convolutions, contribute to this retention of the fæces; but the cæcum seems to be the first organ thereof, because the fæces being first collected there, are obliged afterwards to move in a contrary direction as they ascend into the colon.

377. The valve of the colon, which might more properly be termed the sphincter or pylorus of the ileum, hinders the fæces from returning into the small intestines: I say, the fæces or gross matter, because it is not certain, that this valve entirely stops that passage, or that it always hinders any fluid matter forced downward by the colon from entering the ileum, even in a natural state.

378. The glandular lacunæ of the great intestines furnish continually a kind of mucilage, which not only defends the internal coat from the acrimony of the fæces, but serves also to lubricate these fæces in proportion to their different degrees of solidity.

379. The *appendicula vermiformis* is so very small in adults, that its use cannot be determined with certainty. Perhaps the mucilaginous matter in its cavity, furnished by the numerous glandular lacunæ of its internal coat, which can only be evacuated by plenitude, may, during its stay there, contract an acrimony, which may vellicate or stimulate the cæcum, in order to throw its contents into the colon.

380. The *intestinum rectum* is the last reservatory of the fæces. The great thickness of its muscular coat, and the great number of longitudinal fibres by which this thickness is chiefly formed, enable it to yield to the collected fæces to so great

a degree as to represent a large bladder or stomach. The muscoli levatores ani serve to suspend the lower portion of this intestine, especially when full; and it is partly by the contraction of these muscles which overcome the sphincter of the anus, that the fæces are discharged out of the body. These sphincters form the third pylorus of the whole alimentary canal.

381. The mesentery and mesocolon connect the intestines, in such a manner, as that they cannot be twisted or run into knots, without hindering them from sliding and yielding to each other according to the different postures of the body, or according as they are more or less empty or full.

382. The adhesions of the mesentery form the convolutions of all the small intestines into a large bundle, irregularly round, which fills a great part of the cavity of the abdomen, from the epigastrium downward.

383. The mesocolon by its adhesion to the colon forms a kind of septum transversum, between the small intestines and the viscera contained in the epigastrium; and this septum supports the liver and stomach under the arch of the diaphragm, just as much as it is sustained by the intestines. This natural situation of these viscera is most commonly altered in dead bodies opened after the common method, and without the necessary precautions.

384. The breadth of the mesentery and mesocolon affords a large extent to the ramifications of the arteries, veins, and nerves distributed through them by innumerable communications and anastomoses, by means of which any portion of the intestines may be supplied, though the principal branch which leads to it should happen to be compressed or obstructed.

385. The cellular substance in the duplicature of the mesentery and mesocolon, serves not only for a soft bed to all these ramifications, but also to contain those collections of fat, necessary for the formation of the bile, as I shall observe hereafter; and the cellular substance of the mesentery has likewise one use peculiar to it, which is to invest the lymphatic glands and lacteal vessels, and upon this account it is thicker than that of the mesocolon.

386. The lacteal vessels being first formed by a copious reticular texture round the circumference of the intestines, resembling

resembling the vascular net-work of that canal, and afterwards uniting every where through the duplicature of the mesentery, with the arterial ramifications which they likewise accompany in many places; it is easy to conceive that the pulsation of the mesenteric arteries must propel the chyle in the lacteal vessels from the intestines to the receptaculum chyli, that motion being suitable to the direction of their valves.

387. The liver is the principal organ for the secretion of the bile. The villi of that immense number of glandular cells of which it is composed, filtrate continually from the blood of the vena portæ, small drops of bile which afterwards insinuate themselves into the pori bilarii, and are in part lodged in the vesicula fellea, and in part run directly into the duodenum, in the manner already explained in describing the biliary ducts.

388. The spleen, omentum, appendices epiploicæ, adipose strata of the mesentery, and those of the great intestines, and even of the pancreas, with the whole series of glands in the intestinal canal, seem to contribute to the formation of the bile, as so many auxiliary or rather preparatory organs; but each of them in a different way.

389. It appears, (1.) That the venal blood that returns from all the intestinal glands, and from the pancreas, has left a great portion of its serum. (2.) That the blood which returns from the spleen has undergone a certain change, by its course being mechanically retarded, and likewise that its texture is altered by the action of the numerous nerves sent thither by the plexus splenicus. (3.) That the blood which returns from the omenta, appendices epiploicæ, and from the strata and other collections of fat, is loaded with oil.

390. These three kinds of venal blood meet in the trunk of the vena portæ ventralis, where they are mixed together, and from thence they enter the transverse sinus or trunk of the vena portæ hepatica. In this sinus they are still more intimately mixed, as in a kind of lake, and become one uniform mass of blood, which being forced into the branches of the vena portæ hepatica, only by the supervening blood, from the other vena portæ, and by the lateral pulsations of the ramifications of the hepatic artery, its course must be very slow. The secretion of the bile depends partly on this slow motion,



motion, and partly on these external impulses, as I shall show in another place.

391. The vesicular bile appears to be more exalted than that in the hepatic duct; and by meeting in the ductus cholidochus, they seem to compose a third kind of bile, which without the cystic or vesicular bile would perhaps be too mild; and too acrid without the hepatic. This bile mixes in the duodenum with the pancreatic juice, and with that of the intestinal glands, and from this mixture a fluid results, which is proper to separate the chylous matter from the gross and useless part of the alimentary pulp, as it comes from the stomach.

### § 17. *Renēs et Ureteres.*

392. The kidneys are two pretty solid glandular bodies, situated in the posterior part of the cavity of the abdomen, on each side of the lumbar vertebræ, between the last false ribs, and *Ossa Ileum.* The right kidney lies under the great lobe of the liver, and is consequently lower than the left, which lies under the spleen.

*Situation, figure, and division of the kidneys.*

393. The figure of the kidneys resembles that of a large bean, their circumference being convex on one side, and concave on the other. The concave side is turned to the vertebræ, and the convex side, the opposite way. Their length answers to the distance between the last false rib and *Ossa Ileum*; they are about half as broad as long, and half as thick as broad.

394. In each kidney we observe a fore and back side; an upper and lower extremity; a great and small curvature, and a convexity and concavity.

395. The backside is broader than the fore side; and the upper extremity is a little broader and more incurvated than the lower. The depression in the small curvature is oblong and uneven, resembling a sinus, surrounded by several tubercles; and as it is turned a little toward the fore side, this side is something narrower than the other.

396. The descending aorta and inferior vena cava lie between the kidneys, pretty close to the bodies of the vertebræ, and to each other; the

*Blood-vessels of the kidneys.*

artery

artery being on the left hand, the vein on the right. Each of these large vessels sends out transversely toward each side, commonly one capital branch, which goes to the kidney, and enters the sinus or depression thereof, by several rami, of which hereafter.

397. These vessels were by the ancients termed the *emulgent arteries and veins*, but I chuse rather to call them *arteriæ venæ renales*. Sometimes there are more than one of each kind, which is ofteneft found in the arteries, sometimes on one side only, and sometimes in both.

398. The artery and vein are not of an equal length, and the difference depends on the situation of the aorta and vena cava; for the left renal artery is shorter than the right, because the aorta lies nearest the left kidney; and the left renal vein is longer than the right, because the vena cava lies furthest from the left kidney.

399. These vessels are likewise disposed in such a manner, as that the veins lie more anteriorly than the arteries; because the aorta lies close to the spina dorsi; whereas the vena cava which perforates the diaphragm at some distance from the vertebræ, does not join them, till after it has given off the renal veins.

400. Each artery is surrounded by a nervous net-work, called *plexus renalis*, which furnishes a great number of filaments to the kidneys, that come partly from the semilunar ganglions of the two great sympathetic nerves, and partly from the plexus hepaticus and splenicus. This renal plexus sends likewise some filaments round the renal veins.

401. The kidneys are surrounded by a very loose membranous and cellular covering, called *membrana adiposa*, because in fat persons the cells of this substance are filled with fat. This was for a long time impertinently taken for a duplicature of the peritonæum, the true membranous lamina of which covers only the foreside of the kidneys; and consequently they lie without the peritonæum, because the portion of that membrane that covers them cannot be looked upon as an entire coat; so that the only common coat they have, is the cellular substance which likewise invests the renal arteries and veins in form of a vagina.

402. The

402. The proper coat or membrane of the kidneys is composed of two laminæ, between which there is likewise a very fine cellular substance, which may be made sensible by blowing through a pipe between the two laminæ.

403. The external lamina is very thin, and adheres closely to the internal lamina, by means of the cellular substance. The internal lamina penetrates every where by numerous elongations, into the substance of the kidney, from which it cannot be separated without tearing.

404. The surface of the external lamina is very smooth, polished, and glistening, and it renders the whole surface of the kidney very even and uniform in adults. In children, this convex surface is in a manner divided into several lobes or tubercles, almost as in oxen and calves; and in grown persons we sometimes observe the same inequalities.

405. The blood-vessels having entered the kidneys, are ramified every way, and these ramifications send out other capillary rami, which go all the way to the surface, where they appear like irregular stars, and furnish the proper membrane of the kidneys. Sometimes these two ramifications penetrate to the membrana adiposa, and communicate there with the arteriæ and venæ adiposæ.

406. The proper membrane having surrounded the kidney, all the way to the sinus, joins the vessels at that place, and accompanies all their ramifications through the body of the kidney, in form of a vagina or capsula, and likewise contributes in part to form the pelvis and calices or infundibula, of which hereafter.

407. We sometimes observe a considerable vessel to go in or come out from the convex surface of the kidney, but this is not common; and in that case there is a depression by which the proper membrane enters, and communicates with that portion which goes in by the sinus.

408. The tunica adiposa or common coat, which likewise invests the great vessels to their entry into the kidneys, does not seem to accompany them any farther; but terminates at the sinus, in the interstices between the ramifications.

409. We may distinguish three kinds of substances in the kidney; an exterior substance, which is thick, granulated, and in a manner cortical; a middle substance, which is medullary and radiated, called

*Structure of  
the kidneys.*



*striata, sulcata, or tubularis*, because it seems to be made up of radiated tubes; and an inner substance, which is only a continuation of the second, and terminates on the inside by papillæ; for which reason I have given it the name of *papillaris*.

410. These three substances may be seen distinctly in a kidney cut into two equal parts, through the great curvature. The cortical substance may be observed round the whole circumference; and, by the microscope, we perceive it to be of a spongy granulated, and waving texture, all its parts adhering together in a radiated manner. Its colour is a bright whitish grey.

411. By fine anatomical injections and inflammations, we discover an infinity of small capillary vessels, which run in various directions, between and round the different portions of this substance; and, by the help of a microscope, we see likewise great numbers of small red corpuscles more or less round, and disposed almost like bunches of currants. These small corpuscles are perhaps only the extremities of the cut vessels, filled either with blood or with a coloured injection.

412. The other two substances, that is, the medullary or striated and papillary, are really but one and the same mass, of a more reddish colour, the convex side of which rises at several places into narrow tubercles, lodged in the same number of cavities or depressions. The radiated striæ are afterwards continued to the papillary portion; and the papillæ form in some measure so many centres of these radii, opposite to the tubercles.

413. The medullary substance is likewise distinguished from the cortical, by the arterial and venal arches, which send capillary ramifications on all hands; and its colour is more or less red.

414. The papillæ, which are only a continuation of the medullary substance, as has been said, are often a little paler than that substance. They are ten or twelve in number, very distinct from each other, resembling the same number of cones, with very broad bases and obtuse apices.

415. At the point of each papilla we see, even without a microscope, in a small depression, several very small holes, through which little drops may be perceived to run when the papillæ are compressed. These are little drops of urine, which being filtered, partly in the cortical, partly in the medullary

or

or tubular substance, do afterwards pass through the substance of the papillæ, and are discharged by these orifices.

416. Each papilla lies in a kind of membranous calix or infundibulum, which opens into a common cavity, called the *pelvis*. This *pelvis* is membranous, being of the same structure with the calices, of which it is a continuation; and its cavity in man is not uniform, but distinguished into three portions, each of which contains a certain number of infundibula or calices, together with the papillæ which lie therein; and sometimes we find two or three papillæ in the same infundibulum.

*The pelvis of the kidneys.*

417. At the place where these infundibula surround the bases of the papillæ, they send productions into the medullary or radiated substance of the kidney, which accompany the blood-vessels, and serve for capsulæ or vaginæ to all the vascular arches, both arterial and venal, and to their different ramifications, quite through the cortical substance, and as far as the surface of the kidney.

418. After the infundibula have contracted in a conical form round the apices of the papillæ, each of them forms a small short tube or gullet, which uniting at different distances along the bottom of the sinus of the kidney, form three large tubes which go out from the sinus, in an oblique direction from above downwards, and immediately afterwards unite into one trunk.

*Ureters.*

419. This trunk becomes a very long canal, called the *ureter*. In men, the three tubes supply the place of what is called the *pelvis* in brutes, and might more properly be called the *roots* or *branches* of the ureters than the *pelvis*; which name would agree best to the trunk, as being larger than the rest of the ureter. The ureters are commonly two in number, one for each kidney, but sometimes there are more than two.

420. The situation of the trunk, and of the roots and branches of each ureter, with respect to the renal artery and vein, is in the following manner: The artery is in the upper part of the sinus, and partly before the vein. The vein is about the middle, and between the artery and ureter. The ureter is in the lower part, a little behind the vein, and it is partly surrounded by one branch of the artery.

421. This disposition appears plainer near the anterior

than near the posterior side of the kidney, because this last is broader than the former; and we likewise see there the three branches of the ureter, of which the uppermost is the longest, and the lowest is the shortest, because of their oblique direction downward.

422. From this description, we see that in the human kidney there is no other common or uniform pelvis, but the trunk or head of the ureter, and the three great branches. To have a true idea of their disposition, we must imagine that the ureter enters the kidney by the lower part of the oblong sinus; that it increases gradually in breadth as it advances; and that it is divided into three branches, before it enters the substance of the kidney.

423. One of these branches may be reckoned a direct continuation of the ureter, and it is longer than the rest; being extended from the lower to the upper part of the sinus, and it may be found without much preparation. The other two branches are shorter, and cannot be well discovered without an artificial separation. The angles between these branches at their bases, or at the head of the ureter, are not pointed as those of other ramifications, but formed by a round incurvation, which is generally surrounded by fat.

424. These first branches of the ureters produce other small branches at the bottom of the sinus, which are disposed in pairs. These small collateral branches extend in breadth, and form the infundibula or calices, in which the papillæ are lodged; the great circumference of which produces, in the substance of the kidney, the different vaginæ of the vascular arches and of their ramifications. The internal lamina of the kidney is continued round these vaginæ, and the external lamina is expanded round the first branches, round the trunk, and round all the rest of the ureter.

425. If the trunk of the ureter be split on that side which is next the vertebræ, and this section be continued to the extremity of the superior branch, we may observe immediately above the trunk, two holes lying near each other, which are the orifices of the small collateral branches, and gullets of the infundibula. A little above these holes, there are other two very much like them, and so on all the way to the extremity of the superior branch, which terminates likewise by these gullets



gullets of the infundibula; and in each of these gullets we may observe at least the apex of one papilla.

426. A section begun on the convex surface of the kidney, and carried from thence to the trunk of the ureter, discovers the extent of the papillæ very plainly, and likewise the infundibula, their gullets, &c.; but it will be difficult to give beginners a just idea of the structure of these parts, without the other section.

427. The ureters run down obliquely, and with a very small degree of inflexion, from the kidneys to the lateral parts of the inner or anterior side of the Os Sacrum, and passing between the rectum and bladder they terminate in the last of these viscera, in the manner that shall be explained hereafter.

428. They are composed of three proper coats; the first of which, that surrounds the rest, is of a whitish colour, and of a very compact filamentary texture, being stretched with difficulty, and appearing like a filamentary substance degenerated. The next coat is of a reddish colour, stronger than the first, and made up of different strata and fibres, which intersect each other; but it is very hard to determine, whether they are muscular or simply membranous.

429. The innermost coat is in some measure ligamentary, and lined by a very fine membrane, which covers a very delicate reticular texture of vessels. It is slightly granulated like shorn velvet; and moistened all over by a mucilaginous liquor. It has several longitudinal rugæ, which are intersected by a great number of small transverse rugæ.

430. Besides these proper coats, the ureters are invested by the cellular substance of the peritonæum; the membranous lamina of which covers likewise about two thirds of their circumference, sometimes more, sometimes less, but never surrounds them entirely; so that when they are examined in their natural situation, they appear like ropes lying behind the peritonæum, and jutting out more or less toward the cavity of the abdomen, together with that portion of the peritonæum which covers them.

431. All that has been said about the structure of the ureters, pelvis, arches, striæ, fossulæ, and holes at the apex of the papillæ, appears most distinctly, when these parts are examined in clear water, as I have already often observed.

§ 18. *Glandulæ renales, vulgo capsulæ atrabiliarie.*

432. Immediately above each kidney, lies a glandular body, called by the ancients *capsulæ atrabiliarie*; by others, *capsulæ renales*, *renes succenturiati*, and *glandulæ renales*; and they might be properly enough termed *glandulæ supra-renales*. They are situated on the upper extremity of each kidney a little obliquely, that is, more toward the inner edge and sinus of the kidney than toward the outer convex edge.

433. Each gland is an oblong body with three sides, three edges and two points, like an irregular crescent with its great or convex edge, sharp, and the small concave edge, broad. Its length is about two thirds of the greatest breadth of the kidney, and the breadth of its middle portion is about one third of its extent between the two extremities, sometimes more, sometimes less. Its colour is a dark yellow.

434. It has one anterior, one posterior, and one lower side, which last may be termed the *basis*; and it has one upper, and two lower edges, whereof one is anterior, the other posterior. The upper edge may be called the *crista*, and the two lower edges, the *labia*. One of its extremities is internal, or turned inward toward the sinus of the kidney; the other is external, or turned outward toward the gibbous part of the kidney. The figure of this glandular body may likewise be compared to that of a single cock's comb, or to the top of an helmet.

435. The surface of these glands is uneven; the fore-side is the broadest, and the lower side or basis the narrowest. Along the middle of the anterior side, a ridge runs from the edge of the inner extremity a little above the basis, to the point of the other extremity, and divides this side into two equal parts, like the middle rib of the leaf of a tree, and on the lower side under the basis, there is a kind of raphe or future.

436. The blood-vessels of these glands come from the arteriæ, and *venæ renales*, and *diaphragmaticæ*, and likewise from the aorta and vena cava, from the arteria cæliaca, &c. These vessels are termed the capsular arteries and veins, and as they enter the glands, they seem to be invested by a vagina.

na. They are not always derived from the same sources, neither is their number the same in all subjects; and there is commonly a pretty large vein, which runs along the ridge. The nerves on each side are furnished by the neighbouring femilunar ganglion, and by the renal plexus which depends on it.

437. In the inside of these capsulæ, there is a narrow triangular cavity, the surface of which is full of short, strong villi of a yellowish colour; but in children it is reddish, and of a dark brown in aged people. The sides of this cavity are connected by a great number of filaments; and they appear to be wholly glandular, that is, to be filled with very fine small folliculous corpuscles. Along the top of the gland these sides touch each other immediately.

438. In opening this cavity we find a granulated or follicular substance, which fills it almost entirely; and the blood-vessels are distributed on this substance, as well as on the sides of the cavity. If the section be begun at the great extremity of the capsula, and be continued through the upper edge; and if the lateral portions be afterwards separated, the glandular body appears like a kind of crista, raised from the middle of the bottom of the cavity.

439. This glandular body or nucleus adheres more closely to the bottom or basis of the cavity, than to the two sides, especially near the great extremity; but yet it may be separated, both from the basis and sides, being connected to them by a great number of small filaments. It adheres least to the basis near the small extremity.

440. The capsular vein, which comes ordinarily from the vena renalis, is much larger than the arteries; and it communicates with the inside of the capsula much in the same manner as the vena splenica with the cells of the spleen, for it may be inflated by blowing into any part of the capsular cavity, and the air likewise passes into the vena renalis, &c.

441. This cavity contains an unctuous viscid liquor, of a yellowish red colour, which, with age, changes gradually into a yellowish purple, a dark yellow, and a black yellow; and sometimes it is perfectly black, but even then if it be spread thin on a large surface, it appears yellow. I have sometimes found it not only reddish, but mixed with real blood.

442. The uses of these renal glands have not as yet been discovered;



discovered; and all that we know about the liquor contained in them, is, that it resembles the bile. They are very large in the foetus, and diminish in adults. These two phenomena deserve our attention.

443. They lie sometimes directly on the top of the kidneys, but I never found them on the gibbous part. The gland on the right side is partly connected to the diaphragm, under and very near the adhesion of the great lobe of the liver to that muscle. That on the left side adheres to the diaphragm below the spleen; and both these connections are confined to the contiguous portions of the inferior muscle of the diaphragm. They are involved, together with the kidneys, in the membrana adiposa, of which a very thin portion insinuates itself between the kidneys and glands, and also between them and the diaphragm; so that they adhere to both by the intervention of the cellular substance, which in some subjects contains a stratum of fat.

444. The venal ridge already mentioned, sinks so deep into the fore-side in some subjects, that the upper part of this side appears to be separated from the lower; but this is seen most distinctly when the capsula is examined in clear water.

445. When the capsular vein is opened lengthwise with the point of a lancet, we discover in it a great many small holes, many of which are only the orifices of the rami of the vein, others are simple holes; and it is perhaps through these that the air passes into the gland, as already mentioned.

446. On the outer surface of these capsulae we observe a very thin, distinct coat, separate from the cellular substance that surrounds them. Sometimes this coat is raised by an uneven stratum of fat, which makes it appear granulated; and, for the same reason, the capsulae are of a pale colour like a corpus adiposum.

447. The liquor contained in them appears sometimes in the foetus, and in young children, of a bluish colour inclined to red.

448. To be able to discover the uses of these capsulae, we must not only attend to the two circumstances already mentioned, but also to their external conformation, which is commonly more regular in the foetus, and in children, than in adults and old people. We must likewise consider the consistence and solidity of their substance, which is greater before  
fore

fore birth, and in childhood, than in an advanced old age; in which they are often very flaccid, and very much decayed; and this perhaps may be the reason, why the figures given of these glands taken out of their membrana adiposa, are so very irregular and different from what I have demonstrated for above twenty years past.

### § 19. *Vesica urinaria.*

449. The bladder is a kind of membranous and fleshy pouch or bottle, capable of dilatation and contraction, situated in the lower part of the abdomen immediately behind the symphysis of the *Ossa Pubis*, and opposite to the beginning of the *intestinum rectum*. The figure of it is nearly that of a short oval. It is broader on the fore and back sides, than on the lateral parts: rounder above than below, when empty, and broader below than above, when full.

*Situation, figure, and division of the bladder.*

450. It is divided into the body, neck, and bottom; into an anterior, posterior, and two lateral parts. The upper part is termed the *fundus*, or *bottom*, and the neck is a portion of the lower part, which is contracted like the gullet of some vessels.

451. The bladder is made up of several coats, almost like the stomach. That part of the external coat which covers the upper, posterior, and lateral sides of the bladder, is the true lamina or membrane of the *peritonæum*; and the rest of it is surrounded by a cellular substance, by the intervention of which, the *peritonæum* is connected to the muscular coat.

*Structure of the bladder.*

452. The proper coats are three in number, one muscular, one nervous, and one villous, which is the innermost. The muscular coat is composed of several strata of fleshy fibres; the outermost of which are mostly longitudinal; the next to these are more inclined toward each hand; and the innermost, more and more oblique, and they become at length almost transverse. All these fibres intersect each other in various manners, and they are connected together by a fine cellular substance, and may be separated by inflating that substance.

453. The nervous coat is nearly of the same structure with the *tunica nervosa* of the stomach.

454. The internal coat is something granulated and glandular, and a mucilaginous serum is continually discharged

through it, which moistens the inner surface of the bladder and defends it against the acrimony of the urine. It appears sometimes altogether uneven on the inner side, being full of eminences and irregular rugæ when empty, and in its natural state of contraction. These inequalities disappear when the bladder is full, or when it is artificially distended by air, or by injecting any liquid.

455. At the top of the bladder above the symphysis of the *Ossa Pubis*, we observe a ligamentary rope, which *Urachus*. runs up between the peritonæum and the linea alba of the abdomen, all the way to the navel, diminishing gradually in thickness, as it ascends. This rope had a particular use in the fœtus, as shall be said in another place. It is sufficient to add here, that it is in part originally a production of the inner coats of the bladder, which production is termed *urachus*.

456. This rope is composed likewise of two other ligamentary elongations, which are the extremities of the *Arteria umbilicalis*. the umbilical arteries. These arteries come from the hypogastricæ, run up by the sides of the bladder, and remain hollow and filled with blood, even in adults, as high as the middle of the bladder, through all which space they likewise send off ramifications. Afterwards they lose their cavity, and become ligamentary as they ascend. At the upper part of the bladder they approach each other, and joining the *urachus*, form that rope, which may be termed the *superior ligament of the bladder*.

457. The external fibres of the muscular coat are more numerous than the internal; and the most longitudinal anterior fibres form a kind of incurvation round the *urachus* at the top of the bladder, much like that of one of the fleshy portions, which surround the superior orifice of the stomach, and lower extremity of the œsophagus. This incurvation passes behind the *urachus*.

458. The portion of the peritonæum, which covers the posterior convex side of the bladder, forms a very prominent transverse fold, when the bladder is contracted, which disappears when the bladder is extended. This fold surrounds the posterior half of the bladder, and its two extremities are elongated toward each side; by which elongations a kind of lateral ligaments of the body of the bladder is formed, which are more considerable in children than in adults.

459. The



459. The lower part of the bladder, which deserves the name of *fundus* much better than the upper part, is perforated by three openings, one anterior, and two posterior. The anterior opening is formed by an elongation of all the proper coats, in form of a gullet, turned much in the same manner with the inner orifice of the rostrum of the head of an alembic. This elongation is called the *neck of the bladder*, the description of which belongs to that of the parts of generation in men.

460. The other two openings in the true fundus of the bladder, are formed by the ureters, which, in their course downward already described, run behind the spermatic vessels, and then behind the lower part of the bladder, approaching each other. Each ureter lies between the umbilical artery and vas deferens of the same side; the artery lying on the outside of the ureter, and the vas deferens on the inside.

461. Afterwards they get between the vasa deferentia and the bladder, crossing these canals: and then, at about a finger's breadth from each other, they begin to pierce the coats of the bladder. They run a little way between the muscular and nervous coats, and open into the bladder obliquely, something nearer each other, than when they first entered its coats.

462. The orifices of the ureters in the bladder are something oval and narrower than the cavity of the ureters immediately above them. The edge of these orifices is very thin, and seems to be formed merely by the union of the internal coat of the bladder, with that of the ureters.

463. The arteries of the bladder are furnished by the hypogastricæ or iliacæ internæ, being rami of the arteria sciatica, epigastrica, and umbilicalis on each side. The veins come from those of the same names with the arteries.

*Blood-vessels and nerves of the bladder.*

464. The nerves of the bladder come from the crurales, and also from the sympathetici maximi, by means of their communication with the crurales. It has likewise some nerves from the plexus mesentericus inferior.

465. Besides the ligaments already mentioned, there are likewise two small ones, by which the anterior part of the true fundus of the bladder is connected to the *Ossa Pubis*,

which shall be described with the neck and sphincter, after the history of the parts of generation in both sexes; and I refer to the same place, all that relates to the connection of the bladder with the other neighbouring parts.

§ 20. *The parts of generation in males.*

466. The parts of generation in males are of different kinds, some of them being wholly contained in the abdomen, and others lying without it. *Situation in general and division of these parts.* From this situation, they might properly enough be divided into external and internal parts; and all those belonging to the first class might be described before those of the second.

467. But as it is still more proper to have a regard to the œconomy of these parts, according to which, their functions begin in some internal parts, are continued in some external parts, return again to the internal, and are finished in the external; I shall follow the same order in describing them, and this is what I constantly observe in my public lectures.

468. The first of these four classes comprehends the spermatic veins and arteries; the second, the testes, epididymes, and scrotum; the third, the vasa deferentia, vesicula seminales, and prostates; and the fourth, the corpora cavernosa, urethra, integuments, &c.

469. I formerly made a fifth class out of some of these parts, which I looked upon as accompanying the rest; but I now think it better to include them all in the four classes that I have mentioned.

470. The spermatic arteries go out most commonly from the anterior part of the inferior aorta, near each other, and about an inch lower than the arteriæ renales. *The spermatic vessels.* Their origin oftentimes varies; for I have observed them to arise from the renal artery; and sometimes they go out higher, lower, or more laterally than is common, and each artery has been seen to arise from different places.

471. They run down obliquely in the posterior part of the abdomen within the cellular substance of the peritonæum, passing insensibly from behind, forward; and so parting gradually more and more from the aorta, they cross over the fore-side

foreſide of the ureters, and run through the openings or rings of the abdominal muſcles along with the elongations or productions of the cellular portion of the peritonæum.

472. They are ſmall at their origin, and, in their courſe downward they give off pretty conſiderable lateral ramifications, to the membrana adipoſa, peritonæum, and alſo to the meſentery, where they ſeem to communicate with the meſenteric arteries.

473. They ſometimes paſs through the areolæ, or meſhes of the ſpermatic veins; and before they go out of the abdomen, they are divided into very fine rami, which run in a more or leſs winding courſe, almoſt parallel to each other.

474. Afterwards they enter the cellular productions of the peritonæum, which ſerve them for vaginæ. They do not fluctuate indifferently from one ſide to the other of theſe vaginæ; but are connected along their inner ſurface by thin membranous laminæ, which are likewiſe continuations of the cellular ſubſtance of the peritonæum.

475. The arteries continue the ſame winding courſe within theſe vaginæ, paſſing before the vaſa deferentia, which are likewiſe contained in them; and at length they terminate by ramifications in the epididymes and teſtes, in the manner that ſhall be afterwards explained.

476. The ſpermatic veins accompany the arteries, and have nearly the ſame courſe. The right vein ariſes commonly from the trunk of the vena cava, in the ſame manner as the artery from the aorta; and I have ſometimes obſerved it to go out from the union of the right renal vein with the vena cava, and ſometimes I have ſeen three veins on the right ſide, go out ſeparately from the trunk of the vena cava. The left ſpermatic vein ariſes moſt commonly from the vena renalis ſiniſtra.

477. In their courſe downward, they firſt join the arteries, and, together with them, enter the cellular productions of the peritonæum, to which they are connected in the ſame manner. From their origin to their paſſage through the openings or rings of the abdominal muſcles, they ſend off ſeveral rami to the membrana adipoſa of the kidneys, peritonæum, and meſentery, where they ſeem to communicate with the venæ meſaraicæ, and conſequently with the vena portæ.

478. A little below the place where they croſs over the ureters,



reters, they send out a considerable branch, which is afterwards divided into two rami, one of which communicates with the vena capsularis, and the other oftentimes with the renalis; and lower down they give out the vein, which communicates with the vena mesaraica, as already observed.

479. They differ from the spermatic arteries, not only in that they are larger, and their coats thinner, but also in being more divided and multiplied, as they descend to the rings of the abdominal muscles; and as they gradually produce a large fasciculus of ramifications, the ancients gave to them, and to the arteries, the name of *vasa pyramidalia*.

480. These ramifications often communicate with each other in this course, and form a great number of areolæ, contractions, and convolutions, so as to represent a kind of plexus, which is connected to the cellular vagina of each side, by very fine laminæ; and the artery which accompanies the vein, crosses it in several places, and runs through the areolæ in different directions. These frequent convolutions gave rise to the name of *vasa pampiniformia*, formerly given to these vessels; and their particular adhesions to each other at some places, made it believed, that there were real anastomoses between the artery and the vein.

481. Leal Lealisan Italian anatomist, not attending to the lateral ramifications of the spermatic arteries and veins, believed himself able to establish and demonstrate these pretended anastomoses. The experiments made by him on living animals, prove nothing. His way was, to make a common ligature on both vessels, a little above the testicle, and another on the trunk of the vein, after he had emptied it. Then pressing the aorta to force the blood into the spermatic artery, the vein which he had before emptied, was found to be presently filled.

482. From thence he concluded, that the course of the blood to and from the testicle being obstructed by the inferior ligature, there must be some anastomoses between the two ligatures, through which the vein was supplied with blood. But it is very plain, that this effect was owing to the lateral ramifications of the spermatic artery and vein, and not to his pretended anastomoses. These fine lateral ramifications were well known to Eustachius, but had escaped Leal Lealis.

483. The testes are two glandular bodies, situated near each

each other, without the abdomen, below the interstice between the groins in an adult. The ancients *Testes.* named them *didymi* or *gemini*. Their size is nearly that of a pigeon's egg, and they are of an oval figure, a little flattened at each side. We may consider in each testicle, two extremities, two edges, and two sides. One extremity is situated forward, and a little upward, the other backward, and a little downward; and their edges lie upward and downward.

484. At the upper edge, they have each an appendix, called *epididymis*, together with which it is involved in several coverings; and they are both suspended in a common covering, called the *scrotum*.

485. Each testicle is a spermatic gland formed by a vast number of fine whitish tubes, folded and twisted in different manners, and distributed in different fasciuli, between membranous septa; the whole being surrounded by a strong common covering, named *tunica albuginea*.

486. These septa are disposed longitudinally, divaricating from each other on one side, and approaching on the other. They approach each other along one edge of the testicle, and terminate in a long narrow whitish body, as in a kind of axis.

487. From thence they divaricate in a regular manner, and are fixed by their opposite edges in the inner surface of the tunica albuginea, of which they appear to be a continuation. This white body may be termed the *nucleus of the testicle*.

488. From this description, we see that all these septa are not of an equal breadth; that the interstices between them are in some measure triangular; and that the extent of the small tubes, which lie therein, must be very considerable. They have been reckoned to amount to many ells, by taking the sum of all their several portions; and they may be easily unfolded by a long maceration, which destroys the delicate substance by which all their folds and convolutions are connected and tied down.

489. All these small canals seem to terminate by a smaller number of common trunks at the white body or nucleus already mentioned; which trunks do afterwards pierce the upper part of the anterior extremity of the testicle, and are disposed in several folds along the lateral external part of the upper edge, all the way to the posterior extremity. From this  
union

union arises a long whitish, plaited, fasciculus or bundle, called *epididymis*, which is a Greek term signifying an appendix to the testicle.

490. The epididymis thus formed, may be reckoned a production of the testicle, or a kind of testes accessorius; and it resembles in some measure an arch supported by its centre or frame. It is more contracted at the middle, than at the extremities, by which it is closely united to those of the testicle.

491. Between its extremities it does not immediately touch the testicle, but is only loosely connected to it, by the duplicature of a very fine and almost transparent membrane, as by a kind of ligament. This membrane is the continuation and duplicature of the tunica albuginea or proper coat of the testicle, which having supplied the place of a ligament to the epididymis, afterwards invests it.

492. The epididymis is flat, a little concave on the under side, or that next the testicle, irregularly convex on the upper side, or that turned from the testicle; and these two sides are distinguished by two angular edges; by the innermost of which it is connected to the testicle, in the manner already said, but the outer edge and flat side are loose and free.

493. The anterior extremity or head of the epididymis arises from the testicle; and the posterior extremity or tail, which likewise adheres very closely to it, is incurvated from behind, forward, and a little upward, and contracting by degrees, forms a particular canal, termed *vas deferens*, which shall be described after the scrotum. By this description of the extremities and edges of the epididymis, I demonstrated many years ago, a method to discover whether a testicle viewed extra situm belongs to the right or left side.

494. The scrotum is the cutaneous covering of the testes. Outwardly, it is a bag common to both, formed by a continuation of the skin of the neighbouring parts, and commonly very uneven, having a great number of rugæ on its outer surface. Interiorly it is fleshy, and forms a muscular capsula for each testicle, termed *dartos*.

495. The exterior or cutaneous portion of the scrotum is nearly of the same structure with the skin in general, of which it is a continuation; only it is something finer, and it is likewise



wife plentifully stored with sebaceous glands and bulbs or roots of hairs.

496. Though it is a common covering for both testicles, it is nevertheless distinguished into two lateral parts by a superficial and uneven prominent line, which appears like a kind of future, and from thence has been termed *raphe*.

497. This line is a continuation of that which divides, in the same manner, the cutaneous covering of the penis, and it is continued through the perinæum, which it divides likewise, all the way to the anus. It is only superficial, and does not appear on the inside of the skin.

498. The inner surface of this cutaneous bag is lined by a very thin cellular membrane, through which the bulbs and glands appear very distinctly when we view its inside. The rugæ of the scrotum are in the natural state commonly a mark of health, and then its size is not very large. It increases in size, chiefly according to its length, and then the rugæ disappear more or less according to the degrees of the preternatural state or indisposition.

499. The dartos or fleshy portion of the scrotum, is a true cutaneous muscle; the fibres of which are for the most part strongly connected to the skin, running through *Dartos.* the cellular substance which lies between these two portions in place of a membrana adiposa, but without the least appearance of fat. This muscle is thin, and by the disposition of its fibres forms a bag with two cavities, or two small bags joined laterally to each other, and contained within the cutaneous portion.

500. The lateral parts of these two bags, which are turned from each other, are longer than those which are joined together; and by this union a septum is formed between the testes, which may be called *mediastrinum scroti*.

501. The raphe or future already mentioned adheres to the edge of this septum, and thereby braces down the middle of the cutaneous portion, which from thence appears to have in part two cavities; and this was perhaps what gave occasion to make the French word for the scrotum to be in the plural number. The other edge of the septum adheres to the urethra.

502. The two bags of the dartos are lined on the inner or concave side, by a cellular substance more considerable than

that between the convex side and the skin; so that the fleshy fibres, all the way to the septum, lie between two cellular strata. They run through the outer stratum, as has been said, to be inserted in the skin, and, by their contraction, they form the natural rugæ of the scrotum.

503. These fleshy fibres have likewise a strict connection with the internal cellular membrane, especially at the upper part, below the groin, where the anterior and external lateral portions of the dartos terminate by a kind of tendinous or ligamentary expansion, which is strongly united to the internal cellular membrane. I have often shown this as a particular fascia lata, which gives insertion to the portions of the dartos just mentioned, and as a broad frænum which keeps the same portions together.

504. The aponeurotic or ligamentary expansion of the dartos is fixed in the ramus of the Os Pubis, between the musculus triceps and the origin of the corpus cavernosum of the same side, which shall be described hereafter, all the way to the lower part of the symphysis of these bones. The internal portion of these muscular bags, or that which forms the septum scroti, is fixed to the urethra by means of a communication between the same ligamentary expansion, and another, which shall be explained in its proper place.

505. The vasa deferentia are two white solid flattened tubes, one lying on the right side, the other on the left. From the epididymis of which they are continuations, as has been already said, each of them runs up in the cellular vagina of the spermatic vessels, as high as the openings in the abdominal muscles; the blood vessels lying forward, and the vas deferens behind them.

506. This fasciculus thus formed by the blood-vessels, vas deferens, and their common covering is termed the *spermatic rope*. The covering is smoother on the outer than on the inner side, and for that reason it has been looked upon as a vagina; the internal substance of which is most cellular, and connects all the vessels together, while the external forms a covering to invest them.

507. The vas deferens having reached the membranous lamina of the peritonæum, where that lamina runs over the orifice of the vagina, separates from the blood-vessels, and runs

runs backward, in form of an arch, in the cellular substance of the peritonæum, as far as the nearest side of the bladder.

508. It passes afterwards behind the body of the bladder, to which it adheres very closely, as also to the lamina of the peritonæum which covers it, and then continues its arched course towards the neck of the bladder, where both vasa deferentia meet, and their arches terminate.

509. In this course, the vas deferens passes behind and crosses the neighbouring umbilical artery, crosses the extremity of the ureter of the same side, in its passage between that extremity and the bladder, and having got behind the bladder, it meets the vas deferens of the other side, between the insertions of the ureters, and they run down together to the neck of the bladder.

510. This canal, which at the origin of the epididymis is pretty large and plaited, becomes immediately afterward smaller and smoother, and continues in that form till it gets behind the bladder, where it begins again to be larger and more uneven.

511. It arises from the angular portion or posterior extremity of the epididymis, and from thence runs forward in a very oblique course, on the posterior half of the epididymis, where it is a little incurvated as it joins the backside of the spermatic vessels.

512. The texture of the smooth portion of this canal is very solid, and in a manner cartilaginous, especially near the surface of its cavity, which, though very narrow, is still kept open by means of the solidity and thickness of its sides.

513. The cavity of the vas deferens is cylindrical, though the whole tube is flat, and its external circumference oval, as may be seen by cutting it transversely; and the cavity enlarges as it passes behind the bladder. The termination of these canals must be referred to the history of the urethra.

514. The particular coverings of the testes are commonly called *coats*; and they are reckoned to be three in number; the tunica musculosa, named *cre-* *Coats of the testes.*  
*master*, *vaginalis*, and *albuginea*. The first two are common to each testicle, and to the spermatic rope that belongs to it; and the third is peculiar to the testicle alone.

515. The tunica vaginalis is the most considerable of the three, and must be described first, in order to conceive the



structure and connection of the cremaster, which is very improperly called a *coat*. The albuginea has been already described with the testes.

516. The tunica vaginalis is a continuation of the vagina of the spermatic rope, which, as it approaches the testicle, is gradually dilated, and forms two capsulæ, one contained within the other, the external being the longest and broadest at bottom; so that there is a void space there left between them, in which the testicle is lodged.

517. This structure may likewise be explained in the following manner. The vagina having reached as low as the testicle, is divided into two laminæ, the innermost of which is the bottom of the vagina, and the outermost is expanded round the testicle, and gives it a coat, called *vaginalis*, from the Latin word *vagina*. The ancients termed it likewise *elytroides*, from a Greek word that signifies the same thing.

518. The inner surface of this coat is lined by a fine membrane, which strengthens the bottom of the vagina, and forms a kind of diaphragm, which prevents all communication between the vagina of the spermatic rope and the tunica vaginalis of the testicle.

519. The cremaster, improperly termed a *coat*, is a thin muscle or fleshy plane, which runs down round the vagina of the spermatic rope, and terminates in the tunica vaginalis of the testicle.

520. It surrounds almost the whole vagina, and afterwards expands itself on the upper and external part of the tunica vaginalis, in which it is inserted and lost.

521. It arises partly from the ligamentum Fallopii, and partly from the lower edge of the internal oblique muscle of the abdomen; and on this account, it seems sometimes to arise from the spine of the Os Ilium; and it is probable that the musculus transversalis likewise contributes something to its formation.

522. It is covered by a very fine cellular membrane, detached from the outside of the aponeurosis of the obliquus externus, round the opening commonly called *the ring*. This membrane is lost in the cellular substance of the inside of the dartos.

523. From all this we see that the cremaster is rather a muscle of the tunica vaginalis than a particular coat. Those  
among

among the ancients who believed it to be a coat, called it *tunica erythroides*, from a Greek word which signifies red; but this muscle is not always red, neither is that colour essentially necessary to a fleshy substance.

524. The corpora cavernosa are two ligamentary and very limber tubes, united laterally to each other, through the greatest part of their length, *Corpora cavernosa*, and solid at their two extremities, two of which are connected together, and rounded like the end of a finger; the other two divaricate, like the branches of the Greek Y, and diminishing gradually in size after the divarication, terminate in an oblique point. These divaricated and pointed extremities may be called *the roots*, and the round extremities, *the heads*.

525. These two bodies are almost cylindrical, being round, and of an equal diameter from the roots to the heads, where they are in some measure conical. The ligamentary substance of their sides is elastic, and composed of fine close fibres, which are partly transverse, and partly more or less oblique.

526. The cavity of these ligamentary tubes is entirely filled by a strong cellular or cavernous substance, which does not seem to be a continuation of the substance of the sides. These cells communicate with each other, and are always more or less full of blood, resembling pretty much the cellular substance of the spleen, only with this difference, that the sides of the cells are thicker in these cavernous bodies, and without any additional substance.

527. By the union of the two corpora cavernosa, two external grooves are formed, one on the upper side, the other on the lower. The lower groove is something broader than the upper, and it is filled through its whole length by a third tube, narrower than the corpora cavernosa, called *the urethra*, which shall be presently described.

528. The roots of the corpora cavernosa are fixed, each, to the edge of the small ramus of the ischium and Os Pubis. They meet at the symphysis of the Os Pubis, where each of them becomes a cylindrical tube, and unites with the other in the manner already said.

529. The heads or rounded extremities join the basis of a distinct body, called the *glans*, which is an expansion of the urethra,

urethra, and closely united to it in the manner that shall be explained hereafter.

530. By the union of the corpora cavernosa from their roots to their round extremities or heads, a particular septum is formed by the transverse fibres of both. Between the fibres of this septum, several small void spaces are left, by which the corpora cavernosa communicate with each other, and therefore by blowing into one of them, we presently inflate the other. Toward the rounded extremities, the septum diminishes every way.

531. The urethra is the third spongy tube which com-  
*Urethra.* poses the penis, and it adheres to the corpora cavernosa through the whole length of the interior groove formed by their union. It differs from the other two, both as it is narrower, and as it forms a true hollow canal. Its substance is spongy or cavernous, except a small portion next the bladder, and its inner and outer surfaces are membranous.

532. It is at first no more than a membranous canal continued from the anterior opening of the bladder, at the place called *the neck of the bladder*, which is a name that would be more proper for this portion of the urethra.

533. About a finger's breadth and an half from its origin, it joins a cavernous substance like that of the two other tubes, only smaller, which surrounds it through the whole extent of the inferior groove of the corpora cavernosa.

534. But before this spongy substance begins to surround the urethra, it forms a distinct oblong body, like a pear or onion, which is connected only to the lower convex side of the canal; and afterwards being split on each side, invests it quite round. This body is called *the bulb of the urethra*, being larger than any other part of that canal, and divided interiorly by a very fine membranous septum, into lateral parts; and therefore when it is inflated, it appears to be double or with two heads.

535. The first portion of the urethra, or that which is  
*Prostata.* not covered by the cavernous substance, and which from the bladder to the bulb is only a membranous canal, is sustained by a large solid whitish mass, of the figure of a chestnut, and situated between the bladder and the bulb of the urethra, its basis being toward the bladder,  
the



the apex or point toward the urethra, and the sides lying upward and downward.

536. This body is termed *the prostates*, from a Greek word that expresses its situation before the vesiculæ feminales, and implies a plurality, because it appears to be divided into two lateral lobes, by a hollow groove, which runs through its upper side from the basis to the apex. The first portion of the urethra lies in this groove, adhering very closely to the prostates which surround it.

537. The body of the prostates lies on the intestinum rectum, and the apex is under the internal labium of the cartilaginous arch of the Ossa Pubis. The inner substance is spongy, but very compact, and in each lobe there are several folliculi which open into the first portion of the urethra, toward the bottom of the groove, as we shall see hereafter. The small portion of the urethra, between the apex of the prostates and the bulb, perforates the interosseous ligament of the Ossa Pubis described N<sup>o</sup> 183. This portion is very short, its length being no more than what is sufficient to pass through the hole in the ligament, the backside of which consequently touches the apex of the prostates, and its foreside, the bulb of the urethra. This portion might be called *the neck of the urethra*, and that which lies between the body of the bladder and the prostates might be called *the neck of the bladder*.

538. The spongy substance of the urethra having reached the extremity of the corpora cavernosa, forms a large head called *the glans*, which crowns the three spongy pillars, with this difference however, that it is a continuation of the spongy substance of the urethra, and only adheres to the extremity of the corpora cavernosa without any direct communication. *Glans.*

539. It is for this reason that if we blow into the spongy substance of the urethra, the glans is presently inflated, and no air passes into the corpora cavernosa; but when we blow into one of these bodies, the air passes immediately into the other, the urethra and glans remaining as they were.

540. The figure of the glans is that of a rounded cone, a little flattened at the lower part, and with an oblique prominent basis, the circumference of which is something greater than that of the corpora cavernosa.

541. The

541. The spongy substance of the glans is thick and uniform next the corpora cavernosa, but next the urethra, it is perforated by a continuation of that canal, and is there no thicker than the urethra before the formation of the glans.

542. Therefore the canal of the urethra does not lie in the middle of the glans, but continues its direct course through the lower flat side of it, all the way to the extremity, where it terminates by an oblong orifice.

543. All the convex surface of the gland is covered by a fine villous substance; and that again by a fine membrane, resembling the red part of the lips. The circumference of the basis of the gland has a double row of small papillæ, which may be reckoned sebaceous glands, from which a thick matter is discharged.

544. We have several things to take notice of in the cavity of the urethra. At the bottom of the cavity of the first portion or that which lies within the prostates, there is a small oblong oval eminence, pretty large on the back part, and terminating forward in a point, called *caruncula* or *verumontanum*. The large portion of it is commonly perforated by two holes, sometimes only by one, and very seldom by three; and these are the excretory orifices of the vesiculæ seminales, of which hereafter. Each orifice has a small thin membranous border, which may serve for valves to the excretory ducts of the vesiculæ.

545. On each side of the large portion of the caruncula, there are five or six holes ranked in form of a crescent round its lateral parts; which are the orifices of the excretory ducts of the prostates that come from the folliculi already mentioned, and run in an oblique course to the orifices, in a kind of membranous duplicature.

546. The vesiculæ seminales are soft whitish knotted bodies, about three or four fingers breadth in length, one in breadth, and about three times as broad as thick, situated obliquely between the rectum and lower part of the bladder, in such a manner as that their superior extremities are at a distance from each other, and their lower extremities united between those of the vasa deferentia, of which they imitate both the obliquity and the incurvation.

547. They are irregularly round on the upper part, and their

their breadth decreases gradually from thence. By the union of their lower extremities, they form a kind of fork, the branches of which are broad, and bent like rams horns. These extremities are very narrow, and form a small neck, which runs behind the bladder toward its orifice, and continues its course in the groove of the prostates, through the substance of the contiguous portion of the urethra till its extremities pierce the caruncula, in the manner already said.

548. The inner substance of the vesiculæ is plaited, and in a manner distinguished into several capsulæ, by contorted folds. Their external surface is covered by a fine membrane, which serves for a border and frænum to the folds, and is a true continuation of the cellular substance of the peritonæum. The vesiculæ may easily be unfolded, and all their contortions streightened, and by this means they become much longer than in their natural state.

549. Their inner surface is villous and glandular, and continually furnishes a particular fluid, which exalts, refines, and perfects the semen, which they receive from the vasa deferentia, and of which they are the reservatories for a certain time.

550. The passage of the vasa deferentia into the vesiculæ, is very particular. I have already observed, that these canals are incurvated behind the bladder, and that their contracted extremities unite at that place. They unite in an angle, and run between the contiguous extremities of the vesiculæ; and this union is so close, that the adhering portions seem to form only one middle septum, between two small tubes, each of which is formed, partly by the extremity of one vas deferens, and partly by that of the neighbouring vesicula.

551. This lateral union of the extremities of the vas deferens, and vesicula seminalis on each side, forms likewise a kind of short septum, which terminates in a crescent, like a small semilunar valve, and the extremity of the vas deferens is narrower than that of the vesicula. By this mechanism, the fluid contained in each vas deferens has liberty to enter the contiguous vesicula, but that contained in the vesicula cannot return into the other canal.

552. If we blow into one of the vasa deferentia, after having compressed the urethra, the air inflates the contiguous



vesicula feminalis, and the bladder of urine, without passing into the vesicula, or canal of the other side, except we blow with too great violence.

553. Afterwards the two small tubes, formed each by the extremities of the vas deferens and vesicula, run in between the basis of the prostates, and canal of the urethra; and perforating the sides of that canal obliquely, they terminate in the caruncula, in the manner already said.

554. The inside of the canal of the urethra is lined by a fine membrane, full of capillary blood-vessels; and its surface is perforated by a great number of oblong holes or small lacunæ of different sizes, the largest lying near the glands.

*Lacunæ of the urethra.*

555. These lacunæ, or orifices of the excretory ducts of the same number of small glands, are dispersed through the substance of the urethra. Which ducts run for some way in the spongy substance, along the convex side of the internal membrane of the urethra, and open obliquely from behind, forward, into the great canal. The edges of the lacunæ are semilunar, or like a crescent, because of the obliquity of their opening.

556. A little way from the beginning of the cellular substance of the urethra, we meet with two lacunæ more considerable than the rest, and their ducts are very long. These lacunæ and ducts lead to two glandular bodies, situated on the two convex sides of the spongy substance of the urethra near the bulb. Each of them is about the size of a cherry-stone, but they are oblong and flat, and covered entirely by the muscles called *acceleratores*, of which hereafter. These two bodies are commonly called *prostate inferiores*; but if their situation be carefully examined, they will be found to be higher than the true prostates. There is a third body of the same kind situated more anteriorly.

*Anti-prostate.*

557. The cavity of the urethra resembles nearly that of a small writing pen. It is not every where round, and towards the gland becomes broader and flatter on each side, especially in the gland itself, where there is a kind of oval or navicular fossula.

*Orifice of the urethra.*

558. This canal terminates at the extremity of the glands by a narrow oblong orifice or fissure, which is much less than the

the rest of the cavity. The commissures of this small fissure are turned one toward the convex, the other toward the flat side of the glans; and the labia of the fissure are its lateral parts; and it seems to be surrounded by fleshy fibres

559. The integuments which cover all these parts are three or four in number. The first is the skin with the cuticula; the second is the common cellular membrane, which in this place seldom contains any fat; the third is termed *nervous*; and the fourth is a particular cellular membrane, which is not always to be found.

*The common integuments.*

560. The first of these integuments, the skin, is a continuation of that of the pubis and scrotum, and it adheres to the second all the way to the basis of the gland, where that second integument ends. The rest of the cutaneous integument covers the glans without adhesion, and terminates by an opening. This portion is named *præputium*, and along the whole lower or back side, both of the whole integument in general, and of the *præputium* in particular, there runs a fine suture, which is a continuation of the raphe of the perinæum and scrotum.

*Præputium.*

561. The inner surface of the *præputium* is lined with a fine membrane from the opening all the way behind the basis of the glans, and the same membrane is folded from behind, forward, round the glans, forming the proper integument thereof, and covering very closely its whole villous surface, as far as the orifice of the urethra, where it joins the membrane, which lines the inside of that canal.

562. This proper membrane of the glans, and internal membrane of the *præputium*, form conjointly along the flat part of the glans, from its basis to the orifice of the urethra, a membranous duplicature, which like a septum or mediastinum divides this part into two lateral portions, and limits the motions of the *præputium*; for which reason it is called *frænum præputii*.

563. The surface of the internal membrane of the *præputium* discharges a fluid which prevents it from adhering to the glans, and perhaps serves likewise to dilute that which is collected at the basis of the glans, from the glandulæ sebaceæ, already mentioned.

564. The second common integument of these parts, is nearly the same with what is every where found under the

skin, except that it is not filled with fat and that it is more fibrous than cellular, and a little loose. It accompanies the skin to the basis of the glans, as has been already observed.

565. The third common integument, improperly called *tunica nervosa*, is of a firm, elastic, ligamentary substance, and its fibres are sometimes of a yellowish colour. It invests the corpora cavernosa and urethra from the glans to the symphysis of the *Ossa Pubis*; and at some distance from these bones, it forms on the superior groove of the corpora cavernosa a close duplicature; and by this duplicature, a flat broad ligament which runs directly upward, and is inserted in the forementioned symphysis, as far as the tendinous basis of the *musculi pyramidalis* of the abdomen.

566. This ligament has been called *ligamentum elasticum*, because it yields and recovers itself; and *suspensorium*, because it suspends these parts, by means of its insertion in the symphysis. It sends off a detachment or ala toward each side, one edge of which is fixed between the *musculus triceps* and the *corpus cavernosum*, and forms the ligamentary expansion in which the *dartos* is inserted, as has been already said. It seems likewise to send down another elongation directly to the *perinæum* and anus.

567. The fourth integument of these parts is the *tunica cellulosa* of M. Ruysch, which immediately surrounds the corpora cavernosa and urethra, lying between these and the third integument, from which it seems to be distinguished only by the closeness and fineness of its texture; and it is sometimes hardly perceivable.

568. Several muscles are inserted in the parts, which we have described in this paragraph. They may be reckoned to be ten in number, two for the corpora cavernosa, two for the urethra, two common muscles called *transversales*, and four small ones for the prostates.

569. The first two muscles are commonly termed *erectores*, but might be more properly named *ischio cavernosi*. The next two are called *acceleratores*, but the name of *bulbo cavernosi* would better agree to them. The four small muscles, two of which are superior, and two inferior, may be called *prostatici*. I observed, in the beginning of the description of the muscles,



muscles, that the names taken from the supposed uses are very equivocal.

570. The musculi ischio-cavernosi lie along the roots of the corpora cavernosa; each of them being fixed by one extremity very obliquely, in the internal labium of the ramus of the Os Ischium, from the tuberosity upward. From thence it accompanies the root of the corpus cavernosum, all the way to the symphysis of the Offa Pubis, and is fixed, by its other extremity, in the corpora cavernosa, near their union; where the fibres of both muscles meet, and are reciprocally expanded over both corpora. They lie a little lower, and more interiorly than the roots of these cavernous bodies.

571. I have shown two other musculi accessorii, which I looked upon as lateral acceleratores, or as acceleratores accessorii; fixed lower, and more interiorly in the Os Ischium, than the former, which they accompany all the way to the corpora cavernosa, and then leaving them, they are inserted chiefly in the urethra, near the bifurcation of the musculus bulbo-cavernosus.

572. These bulbo-cavernosi, commonly termed *acceleratores*, form first of all a penniform muscle, by means of a middle tendon, fixed in the lower part of the interosseous ligament of the Offa Pubis, described N<sup>o</sup> 184. and to the union of the musculi transversales, with the sphincters of the anus. From which they pass in an expanded form over the bulb of the urethra, covering that bulb and the urethra itself, and adhering in some measure to both, as high as the origin of the ligamentum suspensorium, the middle tendon answering to the septum of the bulb.

573. Afterwards the two fleshy planes separate, and run obliquely to the right and left hands from behind, forward, and from below, upward; surrounding the corpora cavernosa, in the outer sides of which they are inserted. The middle tendon adheres very strongly to the lower part of the septum of the bulb, in which, and in the urethra itself, several of the fibres of these muscles are fixed.

574. The musculi transversi, called also *triangulares*, are two long, narrow, fleshy fasciculi, inserted, each, by one extremity in the root or beginning of the ramus of the Os Ischium; from whence they run transversely along the edge of the interosseous ligament of the Offa Pubis, as far as the apex  
of

of the prostates, where their other extremities meet, and form commonly a kind of digastric muscle, the middle of which gives insertion to the muscles of the urethra, and to the cutaneous sphincters of the anus.

575. The superior prostatici are two thin planes fixed in the upper part of the inside of the small rami of the *Ossa Pubis*, from whence they are spread over and inserted in the prostates. Their insertions in the *Ossa Pubis* are on one side of those of the *obturatores interni*.

576. The prostatici inferiores are small transverse planes, each of which is fixed in the symphysis, between the ramus of the *Os Pubis* and *Os Ischium*, and from thence runs transversely, till it meets its fellow from the other side under the prostates, to which they are both strongly connected, and they serve like a girth to sustain these glands. They may be considered as two small or internal transversales, and the other two transversales may be distinguished by the names of *great* or *external*. They have likewise some adhesions to the point in which all these muscles hitherto described, are united.

577. The arteries of these parts come chiefly from the *iliacæ internæ* or *hypogastricæ*, and the rest from *Blood-vessels.* the *iliacæ externæ* or *crurales*. The principal arteries are termed *pudicæ*, of which one is external, the other internal.

578. The *pudicæ externæ* send a branch to each side, which having passed out of the pelvis by the side of the *Os Sacrum*, runs on the inside of the *tuberculum ischii*, to the roots of the *corpora cavernosa*, along the inside of the *musculi ischio-cavernosi* or *erectores*. It sends ramifications to the bulbous head of the urethra and to the *corpora cavernosa*; and together with the *gluteæ*, with which it communicates in its passage, it likewise supplies the scrotum.

579. The *pudicæ internæ* having furnished the *intestinum rectum*, bladder, *vesiculæ seminales* and prostates, communicates with the *hæmorrhoidales*, passes under the arch of the *Ossa Pubis*, and partly enters the *corpora cavernosa*, and partly runs along their upper side, sending off small lateral branches, which surround these bodies, like irregular half arches, and penetrate them by numerous ramifications.

580. The *crural* arteries send each likewise a branch, which running behind the contiguous *crural vein*, is distributed to the

the integuments of the penis, by the name of *pudica externa*, and communicates, by lateral ramifications, with those of the *pudica interna*. These communications are not only between the internal and external *pudica* of the same side, but also between those of both sides, which reciprocally communicate with each other.

581. The distribution of the veins follows nearly that of the arteries, but they have more ramifications and communications, as in other places. The principal vein is that which passes directly under the symphysis of the *Ossa Pubis* between the two arteries, and runs along the whole superior groove, formed by the union of the *corpora cavernosa*. It is very large, often double, and very seldom triple; but the trunks do not separate, while in the groove, and it has a great number of valves.

582. This great middle vein is formed by the union of the hypogastric branches, which, after passing on the two inner sides of the pelvis, meet about the middle of the arch of the *Ossa Pubis*. At this place we observe a venal plexus, which covers the upper convex side of the first portion of the urethra, before it is surrounded by the spongy substance.

583. The spermatic vessels, of which I have already described the origin and course all the way to where they go out of the abdomen, having reached on each side near the testicle, are divided into two principal fasciculi, one of which is larger than the other. The largest is the anterior, and is distributed through the testicle, by a prodigious number of very fine capillary ramifications, which accompany all the convolutions and folds of the small canals.

584. The other fasciculus is posterior, and is distributed to the epididymis in the same manner.

585. The spermatic artery is accompanied by a ramus of the epigastric artery, which runs down on the side of it as far as the testicle, where they communicate reciprocally with each other. There is sometimes a small ramus of the hypogastric artery, which accompanies the *vas deferens* to the epididymis, and there communicates with the *arteria spermatica*.

586. The nerves of these organs come from the *lumbares* and *sacri*, and they communicate with the *sympatheticus maximus*, and *plexus mesenterici*. Near the arch of the *Os Pubis*, they form together, on each side, a particular

*Nerves.*

particular



ticular rope, which passes under that arch along the upper side of the neighbouring corpus cavernosum, near the artery already mentioned.

587. In their passage over the corpora cavernosa, they send off a great many rami, which surround these bodies on all sides, between the skin and ligamentary integument; being so disposed, as that the arteries lie between them and the middle vein. They must be examined presently after the skin has been raised, because when the ramifications are dried by the air, they disappear.

588. There are two nerves which accompany the spermatic rope, whereof one comes from the nervi lumbares, near the anterior spine of the Os Ilium, which is incurvated in its passage out of the abdomen through the muscles, and serves to distinguish the cremaster, the other nerve comes from the plexus renalis.

589. There is likewise one nerve on each side, which being produced from the union of the second, third, and fourth pairs of the nervi sacri, especially from the third; goes out of the abdomen above the ligamentum ischio-sacrum, passes by the inside of the tuberosity and small branch of the Os Ischium, and is distributed to the corpora cavernosa, to the muscles belonging to them, and to the neighbouring parts.

### § 21. *The parts of generation in females.*

590. The parts of generation in females, are several in number, some of them external and some internal; and they are all subordinate to one principal internal part, called the *uterus*. The other internal parts are the tubæ Falloppianæ, ovaria, vasa spermatica, ligamenta lata, the ropes or bands called *ligamenta rotunda*, and the canal of the uterus. The external parts are the pubis, the alæ, nymphæ, clitoris, orifice of the urethra, and orifice of the canal of the uterus.

591. The uterus lies between the bladder and the intestinum rectum. It is a body inwardly hollow, outwardly of a whitish colour, of a pretty solid substance, and, except in time of pregnancy, of the figure of a flat flask, being in adults about three fingers bread in length, one in thickness, and two in breadth at one end, and scarcely one at

at the other. This size varies, according to the age of the subject.

592. The broadest portion is termed the *fundus*, and the narrowest, the *neck*. Its situation is oblique, the fundus being turned backward and upward, and the neck, forward and downward; the broad sides lie next the rectum and bladder, and the narrow sides are lateral.

593. The cavity of the uterus is flat, and resembles an oblong triangle, the shortest side of which answers exactly to the fundus, and the two longest sides lie one on the right hand, the other on the left, and they are all bent inward, or toward the cavity formed by them.

594. Of the three angles of this cavity, the two which terminate the fundus, are perforated each by a narrow duct, which with difficulty admits a hog's bristle. The third angle forms a flat duct wider than the former, which perforates the neck of the uterus lengthwise, and terminates at the extremity of that neck, by a transverse opening.

595. This opening is termed *the internal orifice of the uterus*; and in the natural state, is narrower than the duct of the *colum uteri*, so that only a small stilet can be passed through it. At the edge of this orifice, are several small holes, answering to the same number of glandular corpuscles which discharge a viscid lymph.

596. The inner surface of the cavity of the uterus, is lined by a very fine membrane, which at the fundus or broad portion is smooth and even, but in the narrow portion which leads to the orifice, it is wrinkled in a particular manner.

597. The portion of this membrane, which covers the bottom of the cavity, is perforated by a great number of considerable holes, through which small drops of blood may be observed to pass, when the whole uterus is compressed; and sometimes it appears to have very small hairs or villi. Both these villi and holes are observed to be more or less ringed with blood, in those women who die in the time of their menses.

598. In the narrow part, which answers to the *colum*, each side is divided into two lateral parts by a kind of prominent longitudinal line, which is larger in the upper or anterior side, than in the lower or posterior.

599. On each side of these two longitudinal lines, there are lines or rugæ obliquely transverse, and disposed like branches, the longitudinal lines representing trunks. Between and round these rugæ, there are small lacunæ through which a mucilaginous fluid is discharged that closes the orifice of the uterus. We observe likewise in the interstices between the rugæ, several transparent globular corpuscles, which a modern author took for a kind of ova.

600. The substance of the body of the uterus is spongy and compact, with a copious intertexture of vessels. Its thickness is nearly equal and uniform in the sides and edges, but the fundus is thicker toward the middle, than toward the two angles, where the thickness decreases gradually. The edges are likewise much thinner near these angles, than near the extremity of the neck.

601. The uterus is covered by a portion of the peritonæum, which serves it for a coat, and is the continuation of that which covers the bladder and intestinum rectum, running up from the lower and posterior part of the bladder, over the anterior part of the uterus, and from thence over the fundus, and down the backside, and afterwards going to the rectum.

602. On each lateral part or edge of the uterus this portion of the peritonæum, forms a broad duplicature, which is extended on each side, more or less directly to the neighbouring lateral parts of the pelvis, forming a kind of membranous septum, between the anterior and posterior halves of the cavity of the pelvis; and it is afterwards continued in a loose manner, with the peritonæum, on the sides of the pelvis.

603. These two broad duplicatures have the name of *ligamenta lata*, and *vespertilionum ala*. The upper edge of each is partly double, or folded, forming two small distinct duplicatures, which I term the *pinions of the broad ligaments*. The anterior pinion is more raised than the posterior, and they are both very loose.

604. The laminae of all these duplicatures are connected by a cellular substance, in the same manner as the other duplicatures of the peritonæum, and they contain the Falloppian



an tubes, the ovaria, a part of the spermatic vessels, and of those that go to the body of the uterus, the ropes called the *round ligaments*, the nerves, &c.

605. The ovaria are two whitish oval, flat, oblong bodies, situated on the sides of the fundus uteri, to which they are fixed by a kind of short round ligament, and inclosed together with it, in the duplicature of the posterior pinion of the ligamenta lata. *Ovaria.*

606. They are composed of a compact spongy substance, and of several little balls, or transparent vesiculæ, which are called *ova*. The spongy substance surrounds each of these vesiculæ very closely, and seems likewise to furnish them with distinct spongy coverings or calices. These vesiculæ are to be carefully distinguished from other preternatural ones, termed *hydroids*.

607. The ligaments of the ovaria lie in the edges of the posterior pinions of the ligamenta lata, much in the same manner as the umbilical vein, in the anterior or umbilical ligament of the liver. They are round ropes of a filamentary texture, fixed by one extremity to the corner of the fundus uteri, a little above and behind the level of that fundus. They were formerly believed to be hollow, and looked upon as *vasa deferentia*.

608. The Falloppian tubes are too flaccid, conical, and vermiform canals, situated more or less transversely on each side of the uterus, between the fundus and the lateral parts of the pelvis, and included in the anterior duplicatures or pinions of the ligamenta lata. *Tubæ Falloppianæ*

609. Each of them is fixed by its narrow extremities in the corner of the fundus uteri, into which it opens, though by so narrow a duct, as hardly to admit a large bristle. From thence their diameter augments by degrees all the way to the other extremity, where it is about one third part of an inch. The body of the tubæ goes in a winding course, and their large extremity is bent toward the ovaria.

610. These large extremities are irregularly round, and terminate by a narrow orifice, a little plaited and turned toward the ovarium, where it presently expands in form of a membranous fringe, full of plaits and incisures. These fringes are called the *broad ends of the Falloppian tubes*.

611. The breadth of the fringe is not equal in all parts. Its circumference is in a manner oval, and the longest segment of the fringe reaches to, and is fixed in the ovarium. The folds are disposed like laminae on the concave side.

612. These tubes are composed of fleshy fibres, whereof some are longitudinal, and some obliquely circular, with an intertexture of another very fine substance.

613. The anterior pinions of the ligamentum latum serve for a common or external coat to both tubæ, and also to connect them, in the same manner as the mesentery connects the intestines. From thence the tubæ, and especially their fringes come to be loose, and their direction to be very imperfectly determined in the greatest part of the figures.

614. Their cavity is lined by a soft glandular membrane, which is plaited longitudinally, almost like the inner surface of the aspera arteria; and these folds are stronger and broader near the great extremities, than any where else. Their substance seems to be spongy, and the interstices between them are moistened more or less by a fluid, which is continually discharged there.

615. The blood-vessels of these parts are of different kinds, viz. the hypogastric arteries and veins, *Blood-vessels.* the ramifications of which belong chiefly to the body of the uterus; the spermatic vessels, and the two vascular ropes, called *ligamenta rotunda*, which might be more properly termed the *vascular ropes of the uterus* or of the *ligamenta lata*.

616. The hypogastric branches are arterial and venal ramifications, arising from the artery and vein of the same name, which having reached the lateral edges of the uterus, are distributed to all the parts thereof, both internal and external, forming a great number of incurvations and particular intertextures.

617. The arteries of one side communicate both upon the uterus, and through its whole substance, with those of the other side, and the arterial ramifications of each side form numerous anastomoses with each other. The veins communicate together on each side in the same manner; and all these blood-vessels communicate likewise with the spermatic vessels, with the vascular ropes of the *ligamenta lata*, and with the hæmorrhoidales.

618. These

618. These frequent anastomoses may be demonstrated by injecting, or blowing into the hypogastric vessels, having first made proper ligatures to prevent the liquor or air from running into other parts. The extremities of these arteries terminate and open into the cavity of the uterus, as has been already said; and there is this peculiar to the veins, that they communicate with the hæmorrhoidales, and consequently with the vena portæ.

619. The spermatic vessels have nearly the same origin in females as in males, and likewise the same course and intertextures; but they never pass out of the abdomen, being wholly distributed to the ovaria and tubes, and they communicate with the hypogastrics, and with the vascular ropes of the ligamenta lata. The veins are very large in proportion to the arteries, and these vessels send out lateral ramifications, which seem to communicate with the mesaraicæ and vena portæ.

620. The vascular ropes, commonly called the *round ligaments*, are two long small fasciculi of arteries and veins, interwoven and connected together by a fine cellular substance, and they run in the great duplicature of the ligamenta lata, from each corner of the fundus uteri, as far as the annular openings of the abdominal muscles.

621. In this course, each rope thrusts outward or raises the anterior lamina of the duplicature, which consequently gives a kind of coat to these vascular fasciculi, and makes them appear like distinct ropes connected to this foreside of the duplicatures.

622. They seem to arise from the communication between the vasa spermatica and hypogastrica, and might be reckoned a particular continuation of the spermatic vessels. The disposition of their adhesions to the angles of the fundus uteri, with respect to that of the tubes and ligaments of the ovaria which lie all near each other, is this: The tubes lie highest, the ligaments of the ovaria most backward, and the vascular ropes forward, and a little lower than the ligaments of the ovaria.

623. Afterwards they run in a course, nearly resembling that of the spermatic vessels in males, pass out of the abdomen, through the openings of the abdominal muscles, and are lost in the fat of the upper and middle parts of the groins.

It



It may be conjectured, that these vessels furnish the lacunæ, of which hereafter. As they pass out of the abdomen, they are accompanied by a production of the cellular portion of the peritonæum, as the spermatic rope in men, and by a fasciculus of fleshy fibres, representing a kind of cremaster.

624. Besides all the vessels hitherto mentioned, we observe nerves and lymphatics, to which we may add the lactiferous ducts that are seen in an advanced pregnancy. The nerves come from the lumbares, sacri, and sympathetici maximi, in the same manner as in males. *Nerves, lymphatics, &c.* The lymphatic vessels run chiefly in the coats continued from the peritonæum. I shall in another place explain the lactiferous ducts, and also the particular fibres which seem to be interwoven in the substance of the uterus in a pregnant woman, the innermost of which being disposed in a vortical or turbinated manner, gave occasion to M. Ruysch to describe them particularly by the name of *musculus uteri orbicularis*.

625. The pubis is that broad eminence at the lower part of the hypogastrium, between the two inguina, on which hairs grow at a certain age, called in Latin by the same name, and almost of the same kind with those found under the axillæ. *Pubis.* This eminence is owing to a particular thickness of the membrana adiposa which covers the forepart of the Ossa Pubis, and some small portions of the neighbouring muscles.

626. The longitudinal cavity which reaches from the middle and lower part of the pubes, within an inch of the anus, was by the ancients termed *Sinus & alæ.* *sinus*; and they called the lateral parts of the cavity *alæ*, which is a more proper name than that of *labia*, commonly given to them. The places where the alæ are joined above and below, are termed *commisures*; and may likewise be called *the extremities or angles of the sinus*.

627. The alæ are more prominent, and thicker above than below, and lie nearer each other below than above. They are chiefly composed of the skin, cellular substance, and fat. The exterior skin is a continuation of that of the pubes and inguina. It is more or less even, and furnished with a great number of glandular corpuscles, from which a whitish ceruminous matter may be expressed; and after a certain

certain age it is likewise covered in the same manner with the pubes.

628. The inner side of the *alæ* is something like the red portion of the lips of the mouth; and it is distinguished every where from the external side by a kind of line, in the same manner as the red portion of the lips from the rest of the skin; being likewise thinner and smoother than the outward skin. A great number of pores are observable in it, and also numerous glandular corpuscles which furnish a liquor more or less sebaceous; and these corpuscles are larger near the edges than in the other parts.

629. Near the inner edge of the inner surfaces of the *alæ*, on each side of the orifice of the canal of the uterus, we find a small hole more visible than the rest.

*Lacuna.*

These two holes are termed *lacunæ*; and they communicate by two small ducts with the same number of follicular bodies lying in the substance of the *alæ*, and which may be looked upon as small prostates answering to the *glandulæ prostaticæ* in males. When compressed they discharge a viscid liquor.

630. Above the superior commissure, a thin flat ligament runs down from each small branch of the *Ossa Pubis*, which penetrates the fat in the substance of each *ala*, and is lost therein insensibly near the edge. These may be looked upon as the *ligamenta suspensoria* of the *alæ*. The inferior commissure of the *alæ* is very thin or like a membranous ligament, and, together with the neighbouring parts of the inner sides, it forms a fossula, termed *navicularis* or *scaphoides*. The space between the inferior commissure and anus termed *perinæum*, is about a large finger's breadth in length.

631. The other external parts are situated in the sinus, and hid by the *alæ*. Directly under the superior commissure lies the clitoris, with its covering, called *præputium*. A little lower is the orifice of the urethra; and below that is the orifice of the great canal of the uterus. The circumference of this orifice is bordered either by a membranous circle, called *hymen*, or by fleshy portions, termed *carunculæ myrtiformes*. On each side of the clitoris begins a very prominent fold, like a crista, which runs down obliquely on each side of the orifice of the urethra. These folds are termed *nymphæ*, and they might likewise be named *crista clitoridis*. On each

each side of the great orifice lies the small prostatic hole already described.

*Clitoris.* 632. The clitoris appears at first sight like a small imperforated glans. Its upper and lateral sides are covered by a kind of præputium, formed by a particular fold of a portion of the inner side of the alæ; which appears to be glandular, and to discharge a certain moisture, and its inside is granulated.

633. By dissection, we discover in the clitoris a trunk and two branches, as in the penis, made up of a spongy substance, and of very elastic coats, but without any urethra. This substance may be inflated either by air or anatomical injections into the artery, &c. The trunk is divided into two lateral parts by a middle septum, from the bifurcation, to the glans, where it is insensibly lost.

634. The bifurcation of the trunk is on the edge of the cartilaginous arch of the *Ossa Pubis*; and the branches which resemble the roots of the corpora cavernosa are inserted in the inferior rami of these bones, and in those of the *Ossa Ischium*, where they terminate by degrees; but there is sometimes a membranous tube on each side, which reaches to the tuberosity of the ischium.

635. The trunk of the clitoris is sustained by a ligamentum suspensorium fixed in the symphysis of the *Ossa Pubis*, and containing this trunk in its duplicature, nearly as in the other sex.

636. Four muscles or fasciculi of fleshy fibres are inserted in the trunk of the clitoris, two on each side. One of them runs down on the fore side of the neighbouring corpus cavernosum, and is inserted by a tendinous or aponeurotic portion, partly in the extremity of the corpus cavernosum, and partly in the tuberosity of the ischium. These two muscles are called *erectores*, but the name of *ischio-cavernosi* would be more proper.

637. The other muscle on each side lies under the former, and runs down on the side of the urethra and great orifice of the uterus, all the way to the anus; increasing gradually in breadth in its passage, and terminating partly like that which is called *accelerator* in males.

638. These two muscles surround very closely the lateral parts of the urethra, and of the great orifice. They expand  
very



very much as they descend, and are spread on the lower and lateral parts of the great orifice; for which reason several anatomists have looked upon them as muscular sphincters. All these four muscles, and especially the two latter, are oftentimes almost covered with fat.

639. The blood-vessels of the clitoris come chiefly from the hypogastricæ; and the nerves from the second and third pairs of the nervi sacri, by means of which they communicate with the inferior mesenteric plexus, and with the great sympathetici.

640. The nymphæ, cristæ clitoridis, or, as they may likewise be termed, *alæ minores sive internæ*, are two prominent folds of the inner skin of the great or external *alæ*, reaching from the præputium of the clitoris to the two sides of the great orifice of the uterus. They begin very narrow, and having increased in breadth in their course downward, they are again contracted at their lower extremity.

641. They are of a spongy substance, intermixed with glands, several of which may be perceived by the naked eye. Their situation is oblique, their upper extremities lying near each other, and the lower at a much greater distance. In married women they are more or less flaccid and decayed.

642. By the urethra in females, we mean the urinary duct, the orifice of which is between the nymphæ below the glans of the clitoris. The sides of this orifice are a little prominent and wrinkled, and perforated by small lacunæ, from which a viscid or mucilaginous liquor may be squeezed. In time of pregnancy, this orifice is sometimes drawn a little inward.

643. The body of the urethra is a spongy duct of the same structure as in males, but much shorter, situated directly under the trunk of the clitoris, and above the great canal of the uterus adhering to each of these canals between which it lies, by membranous filaments. It passes under the cartilaginous arch of the Ossa Pubis, and terminates by an oblique opening at the neck of the bladder; being bent a little downwards between its two extremities.

644. The internal membrane of the urethra is a little plaited, and perhaps by small holes, which communicate with folliculi, lying hid in its substance, as in males. If we blow into one of these holes, we observe a small canal to be inflated,

which runs from without inwards, and terminates in some places by a kind of sacculus, by compressing which, a viscid liquor is discharged.

645. The continuation of this membrane, which lines the neck of the bladder, forms likewise several rugæ, more or less equal, but that which lines the cavity of the bladder, is wrinkled in an irregular manner when the bladder is empty.

646. The great canal, formerly called *the neck of the uterus*, is situated below the urethra, and above the extremity of the intestinum rectum, a little obliquely, being more raised on the inner and back part, than on the outer and fore part.

647. Its inner or posterior extremity, joins the extremity of the body of the uterus, and surrounds its orifice much in the same manner as the duodenum surrounds the pylorus, or as the ileum is surrounded by the cæcum and colon.

648. The anterior extremity forms the great orifice, which lies under that of the urethra, and above the fossula of the inferior commissure of the alæ.

649. The body of the canal is chiefly made up of a spongy substance, interwoven with numerous blood-vessels, and it is commonly longer and narrower in virgins, than in married women.

650. Its inner or concave surface, has several transverse rugæ, and is covered by a particular membrane. The rugæ are formed by oblong narrow eminences, incurvated like portions of arches, placed very near each other, and disposed in such a manner, as to divide the cavity of the canal, into an upper and lower side.

651. By the union of the extremities of the upper and lower rugæ, a kind of raphe or future is formed on the right and left sides; and both arches are sometimes intersected in the middle, and so form two half-arches; but in this there is some variety.

652. In general, these arches are very considerable in young persons; become gradually more superficial in married women, and are quite lost in time of delivery.

653. The inner or posterior extremity of this great canal, surrounds the orifice of the uterus, a little obliquely, in such a manner, as that the upper side of the canal lies very near the

the orifice, and the lower side, at a greater distance from it, and this makes the extremity of the uterus appear to advance more into the canal on the lower, than on the upper part.

654. The exterior or anterior extremity of the great canal in virgins, and especially before the first eruption of the menses, is commonly bordered by a circular membranous fold, of different breadths, more or less smooth, and sometimes semilunar, which in some subjects leaves but a very small opening, in others a larger opening, and in all, renders the external orifice narrower than the rest of the cavity. This fold called *hymen*, is formed by the union of the internal membrane of the great canal, with that on the inside of the *alæ*, and represents a membranous circle of different breadths, and sometimes uneven.

*Circulus membranofus.*

655. This membranous circle is commonly ruptured after the consummation of marriage; is quite lost in delivery; and afterwards only some irregular portions of it remain, which, from their supposed resemblance to myrtle leaves, have been termed *caruncule myrtiformes*. This circle may likewise suffer some disorder by too great a flux of the menses, by imprudence, levity, and other particular accidents.

*Caruncule.*

656. Each side of the anterior portion of the great canal is covered exteriorly by a thin broad cavernous and vascular plexus, called the *plexus retiformis* of that canal. These two planes run down on each side of the clitoris behind the nymphæ, and likewise cover the urethra like a collar, before they are spread on the great canal.

*Plexus retiformis.*

657. This plexus is strictly united to the muscular portions commonly taken for accelerators or constrictors, lying between these portions and the lateral parts of the urethra and of the great canal.

658. This plexus may be inflated by air like a flaccid spleen, or like the spongy substance of the clitoris, with which it seems to have some communication; and on this account the lateral portions of this reticular plexus have been named *the internal crura of the clitoris*. It is a kind of rete mirabile, composed of vessels which come chiefly from the hypogastricæ.

659. It still remains to be observed, that on each side of



the bottom of the pelvis in both sexes, opposite to the lower part of the bladder, there is an aponeurotic or tendinous ligament, which runs over the inner surface of the musculus obturator internus from before backward. The anterior extremity of this ligament is fixed on one side of the middle portion of the symphysis of the *Ossa Pubis*; and the posterior extremity, to the middle part of the ligamentum sacro-sciaticum described in sect. II.

660. A little above the elongation, called *the neck of the bladder*, there is another ligamentary expansion on each side of the bladder; the forepart of which is narrow, and fixed to the anterior extremity of the ligament already mentioned; and the broad posterior part, to the side of the bladder. These two lateral expansions may be looked upon as proper ligaments of the bladder, by which it is connected to the inner side of both *Ossa Pubis*.

661. To the anterior portion of each of these ligaments of the bladder is fixed a particular fasciculus of fleshy fibres, which run up obliquely on the foreside of the bladder, on which those of each side meeting together, form a kind of muscular intertexture, and unite with the most transverse fibres of the bladder.

662. These two muscular fasciculi form a part, and perhaps the principal part of what is called *the sphincter of the bladder*; but to have a true idea of them, they must be examined in situ, without destroying any of their natural connections. When the bladder is removed out of its place, as is done in the common method of dissection, these fasciculi are cut, and thereby their direction being lost, they appear transverse, and are taken by those who know no better, for portions of an orbicular sphincter.

663. In males, these two fasciculi are partly fixed in the prostates; but in females they are very broad, and appear sometimes to be double on each side, one plane lying above the other. They are to be looked upon as true muscles, fixed by small tendons on the sides of the symphysis of the *Ossa Pubis*.

## S E C T. IX.

*A description of the Thorax.*§ 1. *Introduction.*

1. **I**N the compendious view, sect. VII. I gave a general idea of all the external and internal parts which compose what anatomists call the middle venter, breast or thorax in the human body; and I beg the reader to turn to what was there said, to prevent the necessity of repeating it here.

2. The whole extent of the thorax in a living subject, is commonly determined not only by the sternum, vertebræ of the back and ribs, but also by all *External conformation of the thorax.* that space contained between the articulations of the two arms with the scapulæ, and claviculæ; and in this sense, the outside of the thorax is broader above than below in a healthy subject who has [a moderate share of flesh on his bones.]

3. This breadth of the upper part of the breast is owing to the pectorales majores and latissimi dorsi viewed directly forward or backward. But when we take a direct lateral view of the breast, it appears narrower above than below, not only in an entire subject, but even after every thing has been removed that covers the sides of the thorax, and in the skeleton itself.

4. The common integuments of the thorax are the same with those of the abdomen; and the convex side of this part of the body is likewise covered by several muscles. Anteriorly, we find the pectorales majores and minores, a large portion of the serrati majores, the subclavii, a portion of the scaleni and of the obliqui abdominis externi. Posteriorly, we have all the muscles which cover both sides of the scapula, the serrati postici, and a part of the sacro-lumbares, longissimi dorsi, vertebrales, &c. as in the history of the muscles. Among all the external parts of the thorax, only two are peculiar to it in the human body, I mean the two *eminences* called

called *mammæ*, which must therefore be described in this section.

5. The hard parts which form the sides of the cavity of the thorax, are the twelve vertebræ of the back, all the ribs, and the sternum. The soft parts which complete the sides, are the membrane called *pleura*, which lines the cavity, and the musculi intercostales, sterno-costales, and diaphragma, already described among the muscles.

6. All these hard and soft parts taken together represent a kind of cage, in some measure of a conical figure, flattened on the fore-side, depressed on the back-side, and in a manner divided into two nooks by the figure of the vertebræ of the back, and terminated below by a broad arched basis inclined backward. The intercostal muscles fill up the interstices betwixt the ribs, and so complete the sides of the cavity; the basis is the diaphragm, and the pleura not only covers the whole inner surface of the cavity, but, by forming the mediastinum, divides it into two, one on the right, the other on the left.

## § 2. *Mammæ.*

7. The name of *mammæ* or breasts is given to two eminences more or less round, situated in the anterior and a little toward the lateral parts of the thorax, their centre or middle part lying almost opposite to the bony extremity of the sixth true rib on each side. Their size and figure vary in the different sexes and different ages.

8. In children of both sexes, and in males of all ages, they are commonly no more than cutaneous tubercles, or soft verrucæ of a reddish colour, called *papillæ* or *nipples*, each of them being surrounded by a small, thin, and pretty broad circle or disk, more or less of a brownish colour and an uneven surface, termed *areola*.

9. In females come to the age of puberty, which is sometimes sooner, sometimes later, a third part is joined to the two former, which is a convex protuberance, more or less round, of about five or six fingers in breadth; the papilla and areola being situated near the middle of its convex surface. This is what is properly termed *mamma*, and it may  
be



be termed the *body of the breast*, when compared with the other two parts. It increases with age, and is very large in women with child, and in those that give suck. In old age it decreases and becomes flabby, losing its natural consistence and solidity.

10. The body of the *mammæ* is partly glandular, and partly made up of fat; or it is a glandular substance mixed with portions of the *membrana adiposa*, the *cellulous pelliculæ* of which support a great many blood-vessels, lymphatics, and serous or lactiferous ducts, together with small glandular *moleculæ* which depend on the former; all of them being closely surrounded by two membranes continued from the *pelliculæ*. *Body of the mamma.*

11. The innermost of these two membranes, which is, in a manner, the basis of the body of the *mamma*, is thick and almost flat, adhering to the *musculus pectoralis major*. The second or external membrane is thinner, forming a particular integument for the body of the *mamma*, more or less convex, and adhering closely to the skin.

12. The *corpus adiposum* of the *mamma* in particular, is a spongy cluster, more or less interlarded with fat, or a collection of membranous *pelliculæ*, which, by the particular disposition of their outer sides, form a kind of membrane in shape of a bag, in which all the rest of the *corpus adiposum* is contained. The anterior or outer portion of this bag, or that which touches the skin, is very thin; but that side next the *pectoralis major*, is thick.

13. The glandular body contains a white mass, which is merely a collection of membranous ducts, narrow at their origin, broad in the middle, and which contract again as they approach the *papilla*, near which they form a kind of circle of communication. They are named *ductus lactiferi*. *Ductus lactiferi.*

14. The coloured circle or disk already mentioned is formed by the skin, the inner surface of which sustains a great number of small glandular *moleculæ*, of that kind which Morgagni calls *glandulæ sebaceæ*. They appear very plainly all over the *areola*, even on the outside, where they form little flat heights or eminences at different distances quite round the circle. *Areola.*

15. These tubercles are perforated by small holes, through which

which a kind of sebaceous or cheesy matter more or less liquid, may be squeezed out. Sometimes this is a serous liquor, sometimes a milky serum, and sometimes pure milk, especially in *nursus*; and I have seen both serous and milky drops come out at the same time.

16. From thence I am inclined to think that these holes communicate with the lactiferous ducts, and that the tubercles are a kind of auxiliary papillæ, added to the true ones. The different matters or liquors that may be squeezed from the same glandular body, gives also room to think, that the holes in them communicate by their extremities with several other smaller holes.

17. The tubercle which lies in the centre of the areola, is termed *papilla*, or *the nipple*. It is of different sizes in different ages and constitutions, and in the different conditions of females in particular. In women with child, or who give suck, it is pretty large, and generally longer or higher than it is thick or broad; and when it happens to be short, it causes great uneasiness to the child.

18. The texture of the nipple is spongy, elastic, and liable to divers changes of consistence, being sometimes harder, sometimes more flaccid. It seems to be made up chiefly of ligamentary fasciculi, the extremities of which form the basis and apex of the nipple. These fasciculi appear to be gently folded, or curled during their whole length; and if, by drawing the fibres out, these folds be destroyed, they return again as soon as that action ceases.

19. Between these spongy and elastic fasciculi lie seven or eight particular tubes at small distances from each other, and all in the same direction. These tubes end at the basis of the papilla in the irregular circle of communication of the lactiferous ducts, and at the apex in the same number of almost imperceptible holes or orifices; and as they are closely united to the elastic fasciculi, they are folded in the same manner with them.

20. The body of the papilla is covered by a thin cutaneous production, and by the epidermis. Its outer surface is uneven, being full of small tubercles and wrinkles, among which those near the circumference of the nipple, seem to have a transverse or annular disposition, which however is not uniform.

21. This disposition or direction seems to be owing to the elastic

elastic folds already mentioned; and from this simple structure it is easy to explain how infants in sucking the nipple, and women in drawing the teats of cows, bring out the milk. For the excretory tubes being wrinkled in the same manner as the fasciculi, do by these wrinkles or folds, as by so many valves, hinder the milk contained in the ducts from flowing out; but when the nipple is drawn and elongated, the tubes lose their folds, and the passage becomes straight. Besides this, when they are drawn with a considerable force, the whole body of the mamma is increased in length and contracted in breadth, and thereby the milk is pressed into the open tubes; and thus, by barely pressing the body of the breast, the milk may be forced toward the nipple, and even through the tubes.

22. The arteries and veins distributed through the mammæ, are ramifications of the arteriæ and venæ mammariæ, of which one kind comes from the subclaviæ, and are named *mammariæ internæ*; the others from the axillares, called *mammariæ externæ*.

*Arteries, veins, nerves, &c.*

23. These vessels communicate with each other, with those near them, and with the vasa epigastrica, as was observed in the description of the arteries and veins. The nerves come chiefly from the costales, and, by means of these, communicate with the great nervi sympathetici.

24. The use of the mammæ in the nourishment of children is known to all the world: but it is not certainly known what the papillæ and areolæ in males can be designed for. Milk has been observed in them, in children of both sexes; and this happened to one of my own brothers when he was about two years of age.

*Uses.*

### § 3. *Pleura and mediastinum.*

25. The pleura is a membrane which adheres very closely to the inner surface of the ribs, sternum, and muscoli intercostales, sub-costales, and sterno costales, and to the convex side of the diaphragm. It is of a very firm texture, and plentifully stored with blood vessels and nerves, in all which it resembles the peritonæum; and likewise in that it is made up of an inner true membranous lamina, and a cellular substance



on the outside, which is a production or continuation of the lamina.

26. The cellular portion goes quite round the inner surface of the thorax, but the membranous portion is disposed in a different manner. Each side of the thorax has its particular pleura, entirely distinct from the other, and making, as it were, two great bladders, situated laterally with respect to each other in the great cavity of the breast; in such a manner as to form a double septum or partition running between the vertebræ and the sternum, their other sides adhering to the ribs and diaphragm.

27. This particular duplicature of the two pleuræ is termed *mediostinum*. The two laminæ of which it is made up are closely united together near the sternum and vertebræ; but in the middle, and toward the lower part of the foreside, they are separated by the pericardium and heart, as we shall see hereafter. A little more backward they are parted in a tubular form by the œsophagus, to which they serve as a covering; and in the most posterior part, a triangular space is left between the vertebræ and the two pleura from above downward, which is filled chiefly by the aorta.

28. Before the heart, from the pericardium to the sternum, the two laminæ adhere very closely, and there the mediastinum is transparent, except for a small space near the upper part, where the thymus is situated; so that in this place there is naturally no interstice or particular cavity. The apparent separation is owing entirely to the common method of raising the sternum, as was plainly demonstrated by Bartholinus my first master in anatomy, in his treatise of the diaphragm published at Paris in 1676. I shall have occasion to mention Eustachius's tables, where the same fault is said to be found in another place.

29. The mediastinum does not commonly terminate along the middle of the inside of the sternum, as the common opinion has been. I demonstrated in the year 1715, to the royal academy of sciences, that from above downward, it inclines toward the left side; and that if before the thorax is opened, a sharp instrument be run through the middle of the sternum, there will be almost the breadth of a finger between the instrument and the mediastinum; provided that the sternum remain

main in its natural situation, and the cartilages of the ribs be cut at the distance of an inch from it, on each side.

30. From all this we see not only that the thorax is divided into two cavities entirely separated from each other, by a middle septum without any communication; but also that, by the obliquity of this partition, the right cavity is greater than the left; and from hence we may judge of the uncertainty of trepanning the sternum, which the ancients have recommended in some cases.

31. The cellular portion of the pleura connects the membranous portion of the sternum, ribs, and muscles; to the diaphragm, pericardium, thymus, and vessels; and in a word, to whatever lies near the convex side of the membranous portions of the pleura. It likewise insinuates itself between the laminæ of the duplicature of which the mediastinum is formed, and unites them together. It even penetrates the muscles, and communicates with the cellular substance in their interstices, all the way to the membrana adiposa on the external convex side of the thorax. In this the pleura resembles the peritonæum.

32. The surface of the pleura turned to the cavities of the breast, is continually moistened by a lymphatic serosity which transudes through the pores of the membranous portion. This fluid is said to be secreted by imperceptible glands; but the existence of these glands has not been hitherto demonstrated; as was likewise observed of the glands of the peritonæum.

33. The arteries and veins of the pleura are chiefly ramifications of the intercostals; and these ramifications are exceedingly numerous, and for the most part very small. The *mammariæ internæ* and *diphragmaticæ* likewise send branches hither, which communicate very frequently with those that come from the intercostals.

*Arteries and veins.*

34. The mediastinum has particular vessels called *arteriæ* and *venæ mediastinæ*, which are commonly branches of the subclaviæ. The *mammariæ internæ* send likewise ramifications to the forepart of it, the *diaphragmaticæ* to the lower part, and the *intercostales* and *æsophageæ* to the back part.

35. The nerves are ramifications of the true intercostales, called otherwise *costales* and *dorsales*. Near

*Nerves.*

the vertebræ they communicate with the great sympathetic nerves, improperly called *intercostales*, and but very little with the middle sympathetici or those of the eighth pair.

36. The pleura serves in general for an inner integument to the cavity of the thorax. The mediastinum cuts off *Uses.* all communication between the two cavities, and hinders one lung from pressing on the other when we lie on one side. It likewise forms receptacles for the heart, pericardium, œsophagus, &c. and is continued over the lungs in the manner which shall be explained hereafter.

37. Before we leave the pleura, it must be observed that these portions of it which adhere immediately to the ribs, may be looked upon as the periosteum of their inner sides. This adhesion keeps the pleura stretched, and hinders it from slipping or giving way. It likewise renders this membrane extremely sensible of the least separation caused by a coagulated lymph or accumulated blood; the nervous filaments being likewise in this case very much compressed in inspiration, by the swelling of the intercostal muscles.

#### § 4. *Thymus.*

38. The thymus is an oblong glandular body, round on the upper part, and divided below into two or three great lobes, of which that toward the left hand is the longest. In the fœtus it is of a pretty large size, less in children, and very little in aged persons. In children it is of a white colour, sometimes mixed with red; but in an advanced age its colour is generally dark.

39. The greatest part of the thymus lies between the duplicature of the superior and anterior portion of the mediastinum, and the great vessels of the heart, from whence it reaches a little higher than the tops of the two pleuræ, so that some part of it is out of the cavity of the thorax; and in the fœtus and in children, it lies as much without the thorax as within it.

40. Its particular inward structure and secretions are not as yet sufficiently known to determine its uses, which however seem to be designed more for the fœtus than for adults. It has vessels belonging to it called *arteriæ* and *venæ thymicæ*.

#### § 5. *Cor.*



## § 5. Cor.

41. The heart is a muscular body situated in the cavity of the thorax on the anterior part of the diaphragm, between the two laminæ of the mediastinum. It is in some measure of a conical figure, flattened on the sides, round at the top, and oval at the basis. Accordingly, we consider in the heart the basis, apex, two edges, and two sides, one of which is generally flat, the other more convex.

*Situation in general and conformation.*

42. Besides the muscular body which chiefly forms what we call the *heart*, its basis is accompanied by two appendices called *auriculæ*, and by large blood-vessels, of which hereafter; and all these are included in a membranous capsula, named *pericardium*.

43. It is hollow within, and divided by a septum which runs between the edges, into two cavities, called *ventriculi*, one of which is thick and solid, the other thin and soft. This latter is generally termed the *right ventricle*, the other, the *left ventricle*, though, in their natural situation, the right ventricle is placed more anteriorly than the left, as we shall see hereafter.

44. Each ventricle opens at the basis by two orifices, one of which answers to the auricles, the other to the mouth of a large artery; and accordingly one of them may be termed the *auricular orifice*, the other, the *arterial orifice*. The right ventricle opens into the right auricle, and into the trunk of the pulmonary artery; the left into the left auricle, and into the great trunk of the aorta. At the edges of these orifices are found several moveable pelliculæ, called *valves* by anatomists; of which some are turned inward toward the cavity of the ventricles, called *triglochines*, or *tricuspides*; others are turned toward the great vessels, called *semilunares*, or *sigmoidales*. The valvulæ tricuspides of the left ventricle are likewise termed *mitrales*.

45. The inner surface of the ventricles is very uneven, many eminences and cavities being observable therein. The most considerable eminences are thick fleshy productions, called *columnæ*. To the extremities of these pillars are fastened several tendinous cords, the other ends of which

*Ventriculi.*

which are joined to the valvulæ tricuspidæ. There are likewise other small short tendinous ropes along both edges of the septum between the ventricles. These small cords lie in an obliquely transverse situation, and form a kind of network at different distances.

46. The cavities of the inner surface of the ventricles are small deep fossulæ or lacunæ placed very near each other, with in all prominent interstices between them. The greatest part of these lacunæ are orifices of the venal ducts, to be described hereafter.

47. The fleshy or muscular fibres of which the heart is made up, are disposed in a very singular manner, especially those of the right or anterior ventricle; being either bent into arches or folded into angles.

48. The fibres which are folded into angles are longer than those which are only bent into arches. The middle of these arches, and the angles of the folds are turned toward the apex of the heart, and the extremities of the fibres, toward the basis. These fibres differ not only in length, but in their directions, which are very oblique in all, but much more so, in the long or folded fibres than in the short ones, which are simply bent.

49. It is commonly said, that this obliquity represents this figure 8; but the comparison is very false, and can only agree to some bad figures drawn by persons ignorant of the laws of perspective.

50. All these fibres, regard being had to their different obliquity and length, are disposed in such a manner, as that the longest form partly the most external strata on the convex side of the heart, and partly the most internal on the concave side; the middle of the arches and the angles meeting obliquely and successively to form the apex.

51. The fibres situated within these long ones, grow gradually shorter and straighter all the way to the basis of the heart, where they are very short and very little incurvated. By this disposition, the sides of the ventricles are very thin near the apex of the heart, and very thick toward the basis.

52. Each ventricle is composed of its proper distinct fibres, but the left ventricle has many more than the right. Where  
the

the two ventricles are joined, they form a septum which belongs equally to both.

53. There is this likewise peculiar to the left ventricle, that the fibres which form the innermost stratum of its concave side, form the outermost stratum of the whole convex side of the heart, which consequently is common to both ventricles; so that, by carefully unravelling all the fibres of the heart, we find it to be made up of two bags contained in a third.

54. The anterior or right ventricle is larger than the posterior or left, as was well observed by the ancients, and clearly demonstrated by M. Helvetius. They are both nearly of the same length in men, and in some subjects they end exteriorly in a kind of double apex.

55. All the fibres are not directed the same way, though they are all more or less oblique; for some end toward the right hand, others toward the left, some forward, some backward, and others in the intermediate places; so that, in unravelling them, we find that they cross each other gradually, sometimes according to the length of the heart, and sometimes according to its breadth.

56. The tubes which cross each other transversely, are much more numerous than those which cross longitudinally; which ought to be taken notice of, that we may rectify the false notions that have been entertained concerning the motion of the heart; namely, that it is performed by a contortion or twisting like that of a screw, or that the heart is shortened in the time of contraction, and lengthened in dilatation.

57. The fibres which compose the inner or concave surface of the ventricles, do not all reach to the basis; some of them running into the cavity, and there forming the fleshy columnæ, to which the loose floating portion of the tricuspidal valves is fastened by tendinous ropes.

58. Besides these fleshy pillars, the internal fibres form a great many eminences and depressions, which not only render the inner surface of the ventricles uneven, but give it a great extent within a small compass. Some of these depressions are the orifices of the venal ducts found in the substance of the ventricles, which have been already mentioned. The circumferences of the great openings at the basis of the heart are tendinous, and may be looked upon as the common tendon



don of all the fleshy fibres of which the ventricles are composed.

59. The valves at the orifices of the ventricles are of two kinds; one kind allows the blood to enter the heart, *Valvulae*. and hinders it from going out the same way; the other kind allows the blood to go out of the heart, but hinders it from returning. The valves of the first kind terminate the auriculæ, and those of the second lie in the openings of the great arteries. The first are termed *femilunar* or *sigmoidal valves*, the others *triglochines*, *tricuspidal*, or *mitral*.

60. The tricuspidal valves of the right ventricle are fixed to its auricular orifice, and turned inward toward the cavity of the ventricle. They are three triangular productions, very smooth and polished on that side which is turned towards the auricle, and on the side next the cavity of the ventricle, they have several membranous and tendinous expansions; and their edges are notched or indented. The valves of the auricular orifice of the left ventricle are of the same shape and structure, but they are only two in number; and from some small resemblance to a mitre, they have been named *mitrales*.

61. These five valves are very thin, and fastened by several tendinous ropes to the fleshy columnæ of the ventricles. The cords of each valve are fixed to two pillars; and between these valves there are other small ones of the same figure. They may all be termed *valvulae tricuspidæ, auriculares, or venosæ cordis*.

62. The femilunar valves are six in number, three belonging to each ventricle, situated at the mouths of the great arteries; and they may be properly enough named *valvulae arteriales*. Their concave sides are turned toward the cavity of the arteries, and their convex sides approach each other. In examining them with a microscope, we find fleshy fibres lying in the duplicature of the membranes of which they are composed.

63. They are truly femilunar or in form of a crescent, on that side by which they adhere; but their loose edges are of a different figure, each of them representing two small crescents, the two extremities of which meet at the middle of this edge, and there form a kind of small papilla.

*The aorta in general.* 64. The great artery that goes out from the left ventricle, is termed *aorta*. As it goes out,  
it

it turns a little toward the right hand, and then bends obliquely backward to form what is called *aorta descendens*, which I shall have occasion to mention again hereafter. From about the middle of the convex side of this curvature, three great branches arise, which furnish an infinite number of ramifications to the head and upper extremities of the body; as the descending aorta does in the same manner to the thorax, abdomen, and lower extremities.

65. The trunk of the artery which goes out from the right ventricle, is called *arteria pulmonaris*. This trunk, as it is naturally situated in the thorax, runs first of all directly upward for a small space, then divides laterally into two principal branches, one for each lung; that which goes to the right lung being the longest, for a reason that shall be given hereafter.

*The arteria pulmonaris in general.*

66. The auricles are muscular bags situated at the basis of the heart, one towards the right ventricle, the other towards the left, and joined together by an inner septum and external communicating fibres, much in the same manner with the ventricles; one of them being named *the right auricle*, the other, *the left*. They are very uneven on the inside, but smoother on the outside, and terminate in a narrow, flat, indented edge, representing a cock's comb, or in some measure the ear of a dog; and for that reason a famous anatomist of Leyden would fain have distinguished this edge, by the particular name of *auricle*, calling the rest, the *bag*. They open into these orifices of each ventricle, which I name *auricular orifices*; and they are tendinous at their opening, in the same manner as the ventricles.

*Auricle.*

67. The right auricle is larger than the left, and it joins the right ventricle by a common tendinous opening, as has been already observed. It has two other openings united into one, and formed by two large veins which meet and terminate there, almost in a direct line, called *vena cava superior* and *inferior*. The notched edge of this auricle terminates obliquely in a kind of obtuse point, which is a small particular production of the great bag, and is turned toward the middle of the basis of the heart.

68. The whole inner surface of the right auricle is uneven, by reason of a great number of prominent lines which run across the sides of it, and communicate with each other by

smaller lines, which lie obliquely in the interstices between the former. The lines of the first kind represent trunks, and the other, small branches in an opposite direction to each other. In the interstices between these lines, the sides of the auricle are very thin and almost transparent, seeming to be formed merely by the external and internal coats of the auricle joined together, especially near the point.

69. The left auricle is in the human body a kind of muscular bag or reservoir, of a pretty considerable thickness and unequally square, into which the four veins open, called *venæ pulmonaris*, and which has a distinct appendix belonging to it, like a third small auricle. This bag is very even on both sides; for which reason, one might be led to call it *the trunk of the pulmonary veins*, and its appendix, *the left auricle*. However, the bag and appendix have but one common cavity; and therefore may still be both comprehended under the common name of the *left auricle*. In men, the small portion may likewise be named *the appendix of the left auricle*, but in other animals, the case is different.

70. This small portion or appendix of the left auricle is of a different structure from that of the bag or large portion. Exteriorly, it resembles a small oblong bag, bent different ways, and indented quite round the edges. Interiorly, it is like the inside of the right auricle. The whole common cavity of the left auricle is smaller in an adult subject than that of the right; and the fleshy fibres of this left auricle cross each other obliquely, in strata differently disposed.

71. Besides the great common vessels, the heart has vessels peculiar to itself, called *the coronary arteries* and *veins*, because they in some measure crown the basis of the heart. The coronary arteries, which are two in number, go out from the beginning of the aorta, and afterwards spread themselves round the basis of the heart, to the substance of which they send numerous ramifications.

72. The exterior course of the veins is pretty much the same with that of the arteries, but they end partly in the right auricle, and partly in the right ventricle. They likewise terminate in the left ventricle, but in smaller numbers; and in both they end by certain venal ducts, which open into the *fossulæ* or *lacunæ* already taken notice of, in the uneven in-



ner sides of the ventricles. There are likewise lacunæ of the same kind in the auricles between the prominent lines before mentioned; and in the great bag of the left auricle, we find likewise small holes which seem to have the same use.

73. There are seldom more than two arteries; of which one lies toward the right hand, the other toward the left of the anterior third part of the circumference of the aorta. The right coronary artery runs in between the basis and right auricle, all the way to the flat side of the heart, and so goes half way round. The left artery has a like course between the basis and left auricle, and before it turns on the basis, it sends off a capital branch, which runs between the two ventricles. Another principal branch goes off from the union of the two arteries on the flat side of the heart, which running to the apex, there joins the other branch.

74. The coronary veins are distributed exteriorly, much in the same manner. Their trunk opens principally into the right auricle by a particular orifice furnished with a semilunar valve. All the coronary veins and their ramifications communicate with each other, so that if we blow through a small hole made in any of these branches, having first compressed the auricles and large vessels, we observe that the air swells all the vessels, and the ventricles likewise by passing through the ductus venosi.

75. The heart lies almost transversely on the diaphragm; the greatest part of it being in the left cavity of the thorax, and the apex being turned toward the bony extremity of the sixth true rib. The basis is toward the right cavity, and both auricles, especially on the right, rest on the diaphragm.

*Particular situation  
of the heart.*

76. The origin or basis of the pulmonary artery is, in this natural situation, the highest part of the heart on the fore side, and the trunk of this artery lies in a perpendicular plane, which may be conceived to pass between the sternum and spina dorsi. Therefore some part of the basis of the heart is in the right cavity of the thorax; and the rest all the way to the apex, is in the left cavity; and it is for this reason that the mediastinum is turned toward that side.

77. According to this true and natural situation of the heart, the parts commonly said to be on the right side, are rather anterior; and those on the left side, posterior; and

that side of the heart which is thought to be the fore-side, is naturally the upper side; and the back-side consequently the lower side.

78. The lower side is very flat, lying wholly on the diaphragm, but the upper side is a little convex through its whole length, in the direction of the septum between the ventricles. And it may be proper here to remark, that though commonly received terms of art may still be retained, yet it is necessary to prevent their communicating false ideas to those who have not had an opportunity of making observations themselves, or of being instructed by others.

79. The heart, with all the parts belonging to it, is contained in a membranous capsula called *pericardium*, which is in some measure of a conical figure, and much bigger than the heart. It is not fixed to the basis of the heart, but round the large veins above the auricles, before they send off the ramifications, and round the large arteries, before their divisions.

80. The pericardium is made up of three laminæ, the middle and chief of which is composed of very fine tendinous filaments, closely interwoven and crossing each other in different directions. The internal lamina seems to be a continuation of the outer coat of the heart, auricles, and great vessels. The trunks of the aorta and pulmonary artery have one common coat, which contains them both as in a sheath, and is lined on the inside by a cellular substance, chiefly in that space which lies between where the trunks are turned to each other, and the sides of the sheath. There is but a very small portion of the inferior vena cava contained in the pericardium.

81. It is the middle lamina which chiefly forms the pericardium; and the figure of this bag is not simply conical, its apex or point being very round, and the basis having a particular elongation which surrounds the great vessels, as has been already said, as amply, as the other portion surrounds the heart.

82. The pericardium is closely connected to the diaphragm, not the apex, but exactly at that place which answers to the flat or lower side of the heart; and it is a very difficult matter to separate it from the diaphragm in dissection. This adhering portion is in some measure of a triangular shape, answering

ing to that of the lower side of the heart; and the rest of the bag lies upon the diaphragm, without any adhesion.

83. The external lamina or common covering, as it may be called more properly, is formed by the duplicature of the mediastinum. It adheres to the proper bag of the pericardium by the intervention of the cellular substance in that duplicature, but leaves it where the pericardium adheres to the diaphragm, on the upper surface of which it is spread, as being a continuation of the pleura.

84. The internal lamina is perforated by an infinite number of very small holes, through which a serous fluid continually transudes, in the same manner as in the peritonæum. This fluid being gradually collected after death, makes what is called *aqua pericardii*, which is found in considerable quantities in opening dead bodies while they remain fresh. Sometimes it is of a reddish colour, which may be owing to a transudation of blood through the fine membrane of the auricles.

85. The heart and parts belonging to it, are the principal instruments of the circulation of the blood. *Uses in general.* The two ventricles ought to be considered as two syringes so closely joined together as to make but one body, and furnished with suckers placed in contrary directions to each other, so as that, by drawing one of them, a fluid is let in, and forced out again by the other.

86. The heart is made up of a substance capable of contraction and dilatation. When the fleshy fibres of the ventricles are contracted, the two cavities are lessened in an equal and direct manner, not by any contortion or twisting, as the false resemblance of the fibres to a figure of eight has made anatomists imagine. For if we consider attentively in how many different directions and in how many places, these fibres cross each other, as has been already observed, we must see clearly, that the whole structure tends to make an even, direct, and uniform contraction, more according to the breadth or thickness, than according to the length of the heart, because the number of fibres situated transversely, or almost transversely, is much greater than the number of longitudinal fibres.

87. The fleshy fibres thus contracted do the office of suckers, by pressing upon the blood contained in the ventricles, which blood being thus forced toward the basis of the heart, presses



presses the tricuspidal valves against each other, opens the semilunares, and rushes with impetuosity through the arteries and their ramifications, as through so many elastic tubes.

88. The blood thus pushed on by the contraction of the ventricles, and afterwards pressed by the elastic arteries, enters the capillary vessels, and is from thence forced to return by the veins to the auricles, which like retirements, porches, or antechambers, receive and lodge the blood returned by the veins during the time of a new contraction. This contraction of the heart is by anatomists termed *systole*.

89. The contraction or systole of the ventricles, ceases immediately, by the relaxation of their fleshy fibres, and in that time the auricles which contain the venal blood, being contracted, force the blood through the tricuspidal valves into the ventricles, the sides of which are thereby dilated, and their cavities enlarged. This dilatation is termed *Diastole*.

90. In this manner does the heart, by the alternate systole and diastole of its ventricles and auricles, push the blood through the arteries to all the parts of the body, and receive it again by the veins. This is called the *circulation of the blood*, which is carried on in three different manners.

91. The first and most universal kind of circulation is that by which almost all the arteries of the body are filled by the systole of the heart, and the greatest part of the veins evacuated by the diastole.

92. The second kind of circulation opposite to the first, is through the coronary vessels of the heart, the arteries of which are filled with blood during the diastole of the ventricles, and the veins emptied during the systole.

93. The third kind of circulation is that of the left ventricle of the heart; through the venal ducts of which a small quantity of blood passes, without going through the lungs, which is the course of all the remaining mass of blood.

94. Besides these three different kinds of circulation, there are some peculiarities in the course of the blood, which may be looked upon as particular circulations. Such is the passage of the blood through the liver, spleen, corpora cavernosa of the parts of generation, and through the cavernous sinuses of the

the dura mater. I do not here examine the circulation peculiar to the foetus.

§ 6. *Pulmones.*

95. The lungs are two large spongy bodies of a reddish colour in children, greyish in adult subjects, and bluish in old age; filling the whole cavity of the thorax, one being seated in the right side, the other in the left, parted by the mediastinum and heart, and of a figure answering to that of the cavity which contains them; that is, convex next the ribs, concave next the diaphragm, and irregularly flattened and depressed next the mediastinum and heart.

*Situation in general and figure.*

96. When the lungs are viewed out of the thorax, they represent in some measure an ox's foot, with the forepart turned to the back, the back-part to the sternum, and the lower part to the diaphragm.

97. They are distinguished into the right and left lung; and each of these into two or three portions called *lobi*, of which the right lung has commonly three, or two and a half, and the left lung two. The right lung is generally larger than the left, answerably to that cavity of the breast, and to the obliquity of the mediastinum.

*Division and figure in particular.*

98. At the lower edge of the left lung, there is an indented notch or sinus opposite to the apex of the heart, which is therefore never covered by that lung even in the strongest inspirations, and consequently the apex of the heart and pericardium may always strike against the ribs; the lungs not surrounding the heart in the manner commonly taught. This sinus is expressed in Eustachius's tables.

99. The substance of the lungs is almost all spongy, being made up of an infinite number of membranous cells, and of different sorts of vessels spread among the cells, in innumerable ramifications.

*Structure.*

100. This whole mass is covered by a membrane continued from each pleura, which is commonly said to be double; but what is looked upon as the inner membrane, is only an expansion and continuation of a cellular substance,

*Coats.*

substance, which shall be spoken to, after I have described the vessels of this viscus.

101. The vessels which compose part of the substance of the lungs are of three or four kinds; the air-vessels, *Bronchia.* blood-vessels, and lymphatics, to which we may add the nerves. The air-vessels make the chief part, and are termed *bronchia*.

102. These bronchia are conical tubes, composed of an infinite number of cartilaginous fragments, like so many irregular arches of circles, connected together by a ligamentary elastic membrane, and disposed in such a manner as that the lower easily insinuate themselves within those above them.

103. They are lined on the inside by a very fine membrane, which continually discharges a mucilaginous fluid; and in the substance of the membrane are a great number of small blood-vessels, and on its convex side many longitudinal lines which appear to be partly fleshy, and partly made up of an elastic substance of another kind.

104. The bronchia are divided in all directions into an infinite number of ramifications, which diminish gradually in size; and as they become capillary, change their cartilaginous structure into that of a membrane. Besides these very small extremities of this numerous series of ramifications, we find that all the subordinate trunks from the greatest to the smallest, send out from all sides a vast number of short capillary tubes of the same kind.

105. Each of these numerous bronchial tubes is widened at the extremity, and thereby formed into a small *Vesiculæ.* membranous cell commonly called a *vesicle*. These *bronchiales.* cells or folliculi are closely connected together in bundles; each small branch producing a bundle proportionable to its extent and the number of its ramifications.

106. These small vesicular or cellulous bundles are termed *Lobuli.* lobules; and as the great branches are divided into small rami, so the great lobules are divided into several small ones. The cells or vesicles of each lobule have a free communication with each other, but the several lobules do not communicate so readily.

107. The lobules appear distinctly to be parted by another cellulous substance, which surrounds each of them in proportion to their extent, and fills *Interlobular substance.*



fills up the interstices between them. This substance forms likewise a kind of irregular membranous cells, which are thinner, looser, and broader than the bronchial vesicles.

108. This substance is dispersed through every part of the lungs, forms cellulous or spongy *vaginæ* which surround the ramifications of the bronchia and blood-vessels, and is afterwards spread over the outer surface of each lung, where it forms a kind of fine cellular coat, joined to the general covering of that viscus.

109. When we blow into this interlobular substance, the air compresses and flattens the lobuli; and when we blow into the bronchial vesicles, they presently swell; and if we continue to blow with force, the air passes insensibly into the interlobular substance. We owe this observation to M. Helvetius.

110. All the bronchial cells are surrounded by a very fine reticular texture of the small extremities of arteries and veins which communicate every way with each other. The greatest part of this admirable structure is the discovery of the illustrious Malpighi.

*Vascular texture.*

111. The blood-vessels of the lungs are of two kinds; one common, called *the pulmonary artery and veins*; the other proper, called *the bronchial arteries and veins*.

*Blood-vessels.*

112. The pulmonary artery goes out from the right ventricle of the heart; and its trunk having run directly upward as high as the curvature of the aorta, is divided into two lateral branches, one going to the right hand, called *the right pulmonary artery*, the other to the left, termed *the left pulmonary artery*. The right artery passes under the curvature of the aorta, and is consequently longer than the left. They both run to the lungs, and are dispersed through their whole substance by ramifications nearly like those of the bronchia, and lying in the same directions.

113. The pulmonary veins having been distributed through the lungs in the same manner, go out on each side, by two great branches which open laterally into the reservoir or muscular bag of the right auricle.

114. The ramifications of these two kinds of vessels in the lungs, are surrounded every where by the cellular substance already mentioned, which likewise gives them a kind of va-

gina; and the rete mirabile of Malpighi, described above, is formed by the capillary extremities of these vessels. It must be observed, that the ramifications of the arteries are more numerous and larger than those of the veins, which in all other parts of the body exceed the arteries both in number and size.

115. Besides these capital blood-vessels, there are two others called *the bronchial artery and vein*. The *Bronchial arteries and veins.* artery has become very famous of late, by the description given of it by M. Ruysch. The vein was doubted of for some time, but it exists as really as the artery, and may be easily demonstrated.

116. These two vessels are very small, appearing only like very fine arteries and veins coming from the aorta, vena cava, and their branches, in the manner already said in the description of the arteries and veins; and they seem to have no other use but that of nourishing the lungs.

117. The varieties in the origins of the bronchial arteries and veins, especially of the arteries, their communications or anastomoses with each other, and with the neighbouring vessels, and above all, the immediate anastomosis of the bronchial artery with the common pulmonary vein, are of so great consequence in the practice of physic, that it will be proper to repeat here what I have said about them elsewhere, that the attention of the readers may not be diverted by being obliged to turn to another place of this work.

118. The bronchial arteries come sometimes from the anterior part of the aorta descendens superior, sometimes from the first intercostal artery, and sometimes from one of the œsophagææ. They go out sometimes separately, toward each lung, sometimes by a small common trunk, which afterwards divides to the right and left, near the bifurcation of the aspera arteria hereafter to be described, and follow ramifications of the bronchia.

119. The left bronchial artery comes pretty frequently from the aorta, and the right, from the superior intercostal on the same side, because of the situation of the aorta. There is likewise another which arises from the aorta posteriorly near the superior intercostal, and above the anterior bronchialis.

120. The bronchial artery gives off a small branch to the auricle

auricle of the heart on the same side, which communicates immediately with the coronary artery.

121. In the year 1719, I observed a very plain anastomosis between some branches of the left pulmonary vein, and of one of the arteriæ œsophagææ, which came from the first left intercostalis, together with a bronchial artery of the same side.

122. In that or the following year, I observed likewise an anastomosis between the left bronchial artery and the vena azygos; and in the month of April 1721, I saw an anastomosis between a branch of this artery, and the body of the just-mentioned vein.

123. Sometimes one bronchial artery gives origin to several superior intercostales; and sometimes several bronchial arteries send off separately the same number of intercostals.

124. The bronchial veins, as well as arteries, were known to Galen. These veins are sometimes branches of the azygos, coming from the upper part of the curvature or arch. The left vein is sometimes a branch of the common trunk of the intercostales of the same side; and sometimes both veins are branches of the gutturalis.

125. The lungs have a great many nerves distributed through them by filaments which accompany the ramifications of the bronchia and blood-vessels, and are spread on the cells, coats, and all the membranous parts of the lungs. The *nervi sympathetici medii* and *maiores*, commonly called the *nerves of the eighth pair* or the *intercostals*, form behind each lung a particular intertexture, called *plexus pulmonaris*, from whence nervous filaments go out, which communicate with the *plexus cardiacus* and *stomachicus*. *Nervi.*

126. On the surface of the human lungs, between the external and cellular coat, we observe something that looks like lymphatic vessels; but we ought to take care not to mistake for such vessels a transparent reticular substance observable on the surface of the lungs, after blowing strongly into the lobuli; this appearance being entirely owing to the air which passes through the bronchial vesicles into the interlobular cells, and which, by separating a certain number of lobuli, finds room to lodge between them. The true lymphatic vessels of the lungs are most visible in



brutes; and in a horse, particularly, I have observed one of these vessels to run along a great part of one edge of the lungs.

127. Under the root of each lung, that is, under that part formed by the subordinate trunk of the pulmonary artery, by the trunks of the pulmonary veins, and by the trunk of the bronchia, there is a pretty broad membranous ligament which ties the posterior edge of each lung to the lateral parts of the vertebræ of the back, from that root all the way to the diaphragm.

128. The bronchia already described are branches or ramifications of a large canal, partly cartilaginous, and partly membranous, called *trachea* or *aspera arteria*. *Trachea arteria.* It is situated anteriorly in the lower part of the neck, from whence it runs down into the thorax between the two pleuræ, through the upper space left between the duplicature of the mediastinum, behind the thymus.

129. Having reached as low as the curvature of the aorta, it divides into two lateral parts, one toward the right hand, the other toward the left, which enter the lungs, and are distributed through them in the manner already said. These two branches are called *bronchia*, and that on the right side is shorter than that of the left, whereas the right pulmonary artery is the longest.

130. The trachea is made up of segments of circles of cartilaginous hoops, disposed in such a manner, as to form a canal open on the backpart, the cartilages not going quite round; but this opening is filled by a soft glandular membrane, which completes the circumference of the canal.

131. Each circle is about the twelfth part of an inch in breadth, and about a quarter of that space in thickness. Their extremities are round; and they are situated horizontally above each other, small interstices being left between them, and the lower edge of the superior segments being turned toward the upper edge of those next below them.

132. They are all connected by a very strong elastic membranous ligament fixed to their edges. I have observed the first three segments united into one bent alternately in two different places according to its breadth. Sometimes two are continuous in the same manner.

133. The canal of the aspera arteria is lined on the inside by a particular membrane which appears to be partly fleshy  
or

or muscular, and partly ligamentary, perforated by an infinite number of small holes more or less imperceptible, through which a mucilaginous fluid continually passes, to defend the inner surface of the trachea against the acrimony of the air which we breathe.

134. This fluid comes from small glandular bodies dispersed through the substance of the membrane, but especially from glands something larger than the former, which lie on the outer or posterior surface of that strong membrane, by which the circumference of the canal is completed. The same structure is observable in the ramifications of the trachea from the greatest to the smallest.

135. All the vessels of which the lungs are chiefly composed, that is, the air-vessels or bronchia; and blood-vessels, that is, the pulmonary and bronchial arteries and veins, accompany each other through this whole viscus.

136. They are disposed commonly in such a manner even to the last ramifications, as that a subordinate trunk or branch of the bronchia lies between the like trunks or branches of the pulmonary artery and vein; the bronchial vessels being immediately joined to the bronchia. In some places these three kinds of vessels touch each other in such a manner as to leave a triangular space in the middle.

137. The bronchia are divided into a very great number of ramifications; and the last rami are the pedicles or footstalks of the small lobuli. All the lobuli are angular, oblong, broad, thin, &c. The footstalks send out other smaller membranous pedicles, which are very short, and terminate in the bronchial vesicles or cells, of which they are continuations. The subordinate trunks and rami detach a great number of these pedicles from their convex surface.

138. When we blow into the lungs, the bronchial cells nearest their outer surface, appear like small portions of round vesicles; and from this appearance, all the bronchial cells have got the name of *vesicles*, though they are all angular, except those which I have now mentioned.

139. When we examine a lung without blowing it up, we find that the cartilaginous segments of the bronchia lie so near as to be engaged in each other; and in drawing out any portion of the bronchia by the two ends, these segments are parted, and the whole canal is increased in length; but it contracts

tracts again by means of its elastic membrane as soon as that force is taken off.

140. When we open lengthwise any portion of the pulmonary artery and vein in the same lung, we meet with a great number of transverse rugæ which are destroyed when these vessels are elongated. This is an observation made by M. Helvetius.

141. By virtue of this structure, all the ramifications both of the bronchia and pulmonary arteries and veins, have constantly the same direction, whether the lung be inflated or collapsed; and they contract in length, without being either contorted or folded. In expiration these vessels are elongated and shortened in inspiration.

142. These three vessels lie in a sort of cellular vagina, which accompanies all their ramifications, and is a continuation of the interlobular cells, or cellular substance in the interstices of the lobuli. The pelliculæ which compose it, are, however, disposed there, in a more regular manner, and more longitudinally, than in other places, and thereby appear to form a true vagina.

143. When we blow through a pipe introduced so far as to touch immediately a trunk of the blood-vessels or bronchia, the air runs at first through all the cells that lie nearest that trunk or its branches; but if we continue to blow, it insinuates itself through the whole interlobular substance.

144. At the angle of the first ramification of the trachea arteria, we find on both the fore and back sides, *Bronchial glands.* certain soft, roundish, glandular bodies, of a bluish or blackish colour, and of a texture partly like that of the thymus already described, and partly like that of the glandula thyroides, of which hereafter. There are other glands of the same kind at the origin of each ramification of the bronchia, but they decrease proportionably in number and size. They are fixed immediately to the bronchia, and covered by the interlobular substance; and they seem to communicate by small openings with the cavity of the bronchia.

145. The trachea has several coats, as has been already observed. The outermost or common covering surrounds that part of the trachea which lies in the thorax; but out of the thorax, this first coat is derived from the aponeurotic expansions of the muscles of the neck; and it is between this and the



the following covering that the glands already mentioned are situated.

146. The second is a proper coat, being a continuation of the cellular covering of the lungs; and the pelliculæ thereof nearest the cartilaginous segments, serve them for an external perichondrium. The third membrane lies on the inside, adhering closely to the same cartilages, and supplying to these, the place of an internal perichondrium.

147. The fourth membrane is that which completes the circumference of the cartilaginous circles of the trachea. It consists chiefly of two laminæ or strata, partly muscular and partly tendinous; the external or posterior lamina being made up of longitudinal fibres; and the internal or anterior, of transverse fibres. This membrane is perforated by the small ducts of the above mentioned glands, which discharge a fluid when pressed, and being examined through a microscope they appear vesicular or folliculous, much like those of the stomach.

148. The ligament between the cartilaginous circles are very strong and elastic; and each of them is confined to two cartilages without communicating with any of the rest; being fixed to the edges of these cartilages much in the same manner as the intercostal muscles are inserted in the ribs.

149. As the bronchia penetrate into the substance of the lungs, they gradually lose their cartilages; but the muscular lines or columnæ of M. Morgagni appear as much, and sometimes more than before. The two planes above-mentioned continue likewise to be visible; and we observe very distinctly, sometimes even without a microscope, a great many small holes in the pedicles of the lobuli, and bronchial vesicles or cells, which open from within outwards.

150. Respiration is performed by organs of two kinds. one of which may be looked upon as active, the other as passive. The lungs are of the second kind, and the *Uter.* first comprehends chiefly the diaphragm and intercostal muscles.

151. As soon as the intercostal muscles begin to contract, the arches of the ribs are raised together with the sternum, and placed at a greater distance from each other; by which means the cavity of the thorax is enlarged on the two lateral and anterior sides.

152. At the same instant the diaphragm is flatted or brought

brought toward a plane by two motions, which are apparently contrary; that is, by the contraction of the diaphragm, and the dilatation of the ribs in which it is inserted. The external surface of the thorax being thus in a manner increased, and the cavity of the bronchia being at the same time, and by the same means, less resisted or pressed upon; the ambient air yields to the external pressure, and insinuates itself into all the places where the pressure is diminished, that is, into the aspera arteria, and into all the ramifications of the bronchia, all the way to the vesicles. This is what is called *inspiration*.

153. This motion of inspiration is instantaneous, and ceases in a moment by the relaxation of the intercostal muscles; the elastic ligaments and cartilages of the ribs bringing them back, at the same time, to their former situation. This motion by which the ribs are depressed and brought nearer each other, is termed *expiration*.

154. The pulmonary arteries and veins which accompany the bronchia, through all their ramifications, and surround the vesicles, transmit the blood through their narrow capillary extremities, and thereby change or modify it, at least in three different manners.

155. The first change or modification which the blood undergoes in the lungs, is to have the cohesions of its parts broken, to be attenuated, pounded, and, as it were, reduced to powder. The second is, to be deprived of a certain quantity of serum, which transpires through the lungs, and is what we commonly call the *breath*. The third is to be in a manner reanimated by the impression of the air, whether the whole body of the air enters the blood, whether the common air is only the vehicle of some finer parts which are conveyed to it, or whether the air only compresses and shakes the blood, as it passes round the bronchial vesicles in the reticular capillary extremities of the vessels.

156. The cartilages of the aspera arteria and bronchia serve in general to compose a canal, the sides of which will not sink in or subside by compression, but will nevertheless yield to certain pressures and impulses without breaking. As these cartilages are not complete circles or rings, and as their circumferences are completed by elastic membranes, they allow of these dilatations and contractions which modulate the voice;  
and

and as they are connected by elastic ligaments of a considerable breadth, the alternate elongation and contraction of the bronchia is facilitated in the motions of respiration.

157. I say nothing here of the larynx, which is commonly looked upon as the upper part of the aspera arteria, but refer the description of it to that of the head, with which it has a particular connection in relation to the tongue; and this I do the more willingly, because I have included in the same treatise, all that relates to the neck, as not furnishing matter enough for a particular section, though, in the general division of the human body, it may naturally enough be looked upon as a distinct part lying between the head and the thorax.

### § 7. *Oesophagus.*

158. The oesophagus is a canal partly muscular and partly membranous, situated behind the trachea arteria, and before the vertebræ of the back, from near the middle of the neck, down to the lower part of the thorax; from whence it passes into the abdomen through a particular hole of the small or inferior muscle of the diaphragm, and ends at the upper orifice of the stomach.

*Situation and figure.*

159. It is made up of several coats almost in the same manner as the stomach, of which it is the continuation. The first coat, while in the thorax, is formed only by the duplicature of the posterior part of the mediastinum, and is wanting above the thorax and in the neck, where the outer coat of the oesophagus is only a continuation of the cellular substance belonging to the neighbouring parts.

*Structure and coats.*

160. The second coat is muscular, being made up of several strata of fleshy fibres. The outermost are mostly longitudinal; but they are not all continued from one end of the canal to the other. The following strata are obliquely transverse, and the innermost are turned a little obliquely the contrary way. They cross each other irregularly in many places, but are neither spiral nor annular.

161. The third is termed the *nervous coat*, and is like that of the stomach and intestines. It is differently folded or plaited according to its length, being much wider than the muscular coat; and it is surrounded by a whitish, soft, fine fila-



mentary substance like a kind of cotton, which, when steeped in water, swells and grows thicker.

162. The fourth or innermost coat resembles in some measure that of the intestines, except that instead of the villi it has small and very short papillæ. It is folded lengthwise like the third coat; so that the œsophagus, when cut across, represents one tube within another. Through the pores of this coat, a viscid lymph is continually discharged.

163. The œsophagus, from its very beginning, turns a little to the left hand, and naturally runs along the left extremities of the cartilages of the aspera arteria. The thyroide gland, and those which lie behind the middle of the œsophagus, shall be described in another place; and I refer the pharynx as well as the larynx to the description of the head, for a reason that shall be given there.

#### § 5. *Ductus thoracicus.*

164. The thoracic duct is a thin transparent canal, which runs up from the receptaculum chyli, along the spina dorsi, between the vena azygos and aorta, as high as the fifth vertebra of the back or higher. From thence it passes behind the aorta toward the left hand, and ascends behind the left subclavian vein, where it terminates in some subjects, by a kind of vesicula, in others by several branches united together, and opens into the backside of the subclavian vein near the outside of the internal jugular.

165. This canal is plentifully furnished with semilunar valves turned upward. Its opening into the subclavian vein in the human body, is, in the place of valves, covered by several pelliculæ so disposed as to permit the entrance of the chyle into the vein, and hinder the blood from running into the duct. It is sometimes double, one lying on each side, and sometimes it is accompanied by appendices called *pampiniformes*.

## S E C T. X.

*A description of the Head.*

1. **I**N the description of the abdomen and thorax, I began by an account of the external parts of these two cavities of the human body; and afterwards I proceeded to the internal parts; but I must observe a different order in describing the head. I shall here explain first of all, the contents of the cranium, or all that lies within the bony cavity; and afterwards all that surrounds it on the outside; and it is very proper that the reader should review what has been said concerning the structure of the cranium in both treatises of the bones, before he begins this section.

2. The head, being considered in general as one of the three principal cavities of the human body, has this peculiar to it, that its outside is the seat and basis of several very complex particular organs, whereas on the inside it contains only one, which is indeed the organ of organs, and the primum mobile of the whole animal œconomy; I mean the brain, the mechanism of which is very little known; and the structure of its different parts, even of those which we are supposed to be most acquainted with, is very difficult to be demonstrated.

## A R T. I.

*The brain and its appendages.*

3. **T**HE name of *brain* is given to all that mass which fills the cavity of the cranium, and which is immediately surrounded by two membranes called *meninges* by the Greeks, and *matres* by other ancients, because they were commonly of opinion that these membranes were the origin, and, as it were, the mother of all the other membranes of the body.

4. This general mass is divided into three particular portions; the cerebrum or brain properly so called, the cerebellum,

bellum, and medulla oblongata. To these three parts contained within the cranium, a fourth is added, which fills the great canal of the spina dorsi, by the name of *medulla spinalis*, being a continuation of the medulla oblongata.

5. The meninges or membranes are two in number, one of which is very strong, and lies contiguous to the cranium; the other is very thin, and immediately touches the brain. The first is named *dura mater*; the second *pia mater*, which is again divided into two, the external lamina being termed *arachnoides*; the internal retaining the common name of *pia mater*. I begin by these meninges.

### § 1. *Dura mater.*

6. The dura mater incloses the brain and all its appendages. It lines the inside of the cranium, and supplies the place of an internal periosteum, being spread in holes and depressions, and covering all the eminences in such a manner as to prevent their being hurtful to the brain.

7. In describing the *dura mater* we must take notice, 1. *Divison.* Of its composition. 2. Its adhesions to the cranium. 3. Its folds or septa. 4. Its productions, vessels, and nerves.

8. The *dura mater* is made up of two laminæ, adhering very closely together; the fibres of both crossing each other obliquely. By rubbing any part of this membrane between the fingers, we easily perceive the two laminæ sliding a little upon each other. Their texture is very close and strong, appearing to be partly ligamentary and partly tendinous.

9. The *dura mater* sticks closely to the cranium by a great number of filaments of the external lamina, which enter the pores of the bones chiefly at the sutures both above and below; and by penetrating these joints, they communicate with the external periosteum. These filaments are, for the most part, small vessels, which being broken in separating the *dura mater* from the skull, a great number of red points appear on the external surface of that membrane.

10. It adheres much more to the whole inner surface of the cranium in children and young persons than in those of an



an advanced age; the filaments become then very small, being compressed by the contraction of the bony pores; and consequently they are more easily ruptured by any force applied to them.

11. These adhesions are formed entirely by the external lamina. The internal lamina is very smooth and polished on the inside, which is also continually moistened by a fine fluid discharged through its pores, much in the same manner as the peritonæum and pleura. *Internal lamina.*

12. The folds of the dura mater are made by the internal lamina; and three of them form particular septa; one of which is superior, representing a kind of mediastinum between the two great lobes of the brain. The second is in a middle situation like a diaphragm, between the cerebrum and cerebellum; the third is inferior between the lobes of the cerebellum. The superior septum is longitudinal in form of a sithe, from whence it is termed the *falx of the dura mater*; and it may likewise be called *septum sagittale, verticale, or mediastinum cerebri*. The middle septum is transverse, and might be called *the floor of the cerebrum, the diaphragm of the brain, or the tent of the cerebellum*. The inferior septum is very small, and runs down between the lobes of the cerebellum; on which account it may be termed either simply *septum cerebelli*, or *septum occipitale minus*; the middle partition being looked upon as the *septum occipitale majus*. *Folds and Septa.*

13. The superior or verticle septum, called the *falx of the dura mater*, is a long and broad fold or duplicature of the internal lamina, reaching from the edge of the crista Ossis Cribrosi, along the sagittal future, to the middle of the transverse septum; which it joins in such a manner, as that the lateral laminæ of the falx are continuous on each side with the neighbouring portions of the superior lamina of the middle septum.

14. It is broader where it joins the middle septum than at the Os Ethmoides, and it is thicker at that edge which adheres to the cranium than at the other which lies loose and is very sharp, and from this resemblance to a sithe, it had the name of *falx*.

15. The transverse or middle septum is fixed to the Os Occipitis

Occipitis along the grooves of the lateral sinuses, and those of the great angles of the apophyses petrosæ all the way to the posterior clinoid apophyses of the Os sphenoidale. By this situation it forms a sort of floor, tent, or shallow vault, on the forepart of which is a large notch almost of an oval figure.

16. This septum divides the cranium into two cavities, one large or superior, and the other small or inferior, which communicate together by the great oval notch. It is formed by a particular fold, and a very broad membrane of the internal lamina of the dura mater; and in the natural state it is very tense, because of its union or rather continuity with the falx.

17. This union or continuity of these two septa, keeps them both very tense, so that the middle septum is capable of sustaining a considerable weight without sinking downward; and the falx is able to resist lateral pressures, without giving way to the right hand or to the left.

18. We may be convinced of this reciprocal tension by first touching these two septa in their natural state; and again, after they have been cut one after the other according to their breadth, or rather after having cut in this manner the falx in one subject, and the transverse septum in another; for as soon as the falx is cut, the other will be perceived immediately to loose its tension and firmness; and the same thing will be observed in the falx as soon as we cut the septum medium.

19. The small occipital septum is both very short and narrow. It runs down from the middle of the transverse septum, to the edge of the great occipital hole, being fixed to the internal spine of the Os Occipitis. It is formed by a fold and duplicature of the internal lamina of the dura mater, in the same manner as the other two, and distinguishes the lower part of the occipital cavity of the cranium into two lateral parts. In some subjects this septum is double, answering to the double spine of the Os Occipitis.

20. Besides these large folds, there are two small lateral ones on each side of the sella sphenoidalis, each running from the posterior to the anterior clinoid apophysis on the same side. These two folds, together with the anterior or posterior parts of the sella sphenoidalis,

*Sphenoidal  
folds.*

noidalis, form a small fossula in which the pituitary glands is lodged. There are likewise two anterior folds, at the edges of the sphenoidal or superior orbital fissures, which augment the depth of the middle fossulæ of the basis cranii. Thus we have seven folds of the internal lamina of this membrane, three large and four small, which may be termed *internal productions* or *processes of the dura mater*.

21. The elongations of the dura mater are productions of both laminæ, which go beyond the general circumference, and pass out of the cranium, through the openings described in the treatise of the skeleton; and in this they differ from the folds which are formed entirely by one lamina, and do not go out of the skull. They may be named *external productions of the dura mater*.

22. The most considerable of these elongations passes through the great occipital foramen, and runs down the common canal of the vertebræ in form of a tube, lining the inside of that canal, and inclosing the medulla spinalis, by the name of the *dura mater* of that medulla. The other elongations accompany the nerves out of the cranium in form of vaginæ, which are more numerous than the nervous trunks reckoned in pairs. For the olfactory nerves, there is the same number of distinct vaginæ as there are holes in the lamina ethmoidalis; and some nerves are accompanied by several vaginæ through one hole, as those of the ninth pair.

23. There are two particular elongations which form the periosteum of the orbits, together with the vaginæ of the optic nerves. These orbital elongations go out by the sphenoidal or superior orbital fissures, and increasing in breadth in their passage, line the whole cavity of the orbits, at the edges of which they communicate with the pericranium and periosteum of the face. They communicate likewise through the sphenomaxillary or inferior orbital fissures with the pericranium of the temporal and zygomatic fossæ; and by these communications we may explain the accidents which happen to these parts, in wounds of the head.

24. The elongations of the dura mater which accompany the blood-vessels through the foramina of the cranium, unite with the pericranium immediately afterwards. Such, for instance, are the elongations which line the fossulæ of the foramina



mina lacera or jugularia, and the bony or carotid canals of the apophysis petrosa, &c.

25. The vessels of the dura mater are arteries, veins, and sinuses. The arteries in general are distinguished into *Arteries.* to anterior, middle, and posterior, and come from the carotids and vertebrales on each side. The external carotid sends a branch through the spinal hole of the Os Sphenoidale, which is the middle artery of the dura mater, and is called, by way of eminence, *arteria duræ matris*. It is divided into a great number of branches which are plentifully dispersed through the substance of the external lamina as high as the falx, where these ramifications communicate with their fellows from the other side. The impressions of this artery are seen on the inside of the parietal bones, the anterior and lower angle of which, instead of a simple impression, contains a canal for the passage of a trunk or branch of this artery, on which account several accidents happen in fractures of the skull, as I demonstrated at the royal garden above eight years ago.

26. The external carotid sends another small ramus through the corner or small end of the sphenoidal or superior orbital fissure, where there is sometimes a little notch on purpose, mentioned in the description of the skeleton. This branch is the anterior artery of the dura mater, and it gives off ramifications in the same manner as the former with which it communicates, but its ramifications are not so numerous. The internal carotid, as it enters the cranium, gives off a small branch to the substance of the dura mater.

27. The two vertebral arteries enter by the great occipital foramen, and unite in one trunk on the anterior or sphenoidal apophysis of the Os Occipitis. Immediately afterwards, they enter the substance of the dura mater on both sides, each of them by one or two branches. These are the posterior arteries of the dura mater; and they communicate by some ramifications with the middle or spinal artery above-mentioned.

28. The dura mater contains in its duplicature several particular canals, into which the venal blood not only of that membrane, but of the whole brain, is carried. These canals are termed *sinuses*, and some of them are disposed in pairs, others in uneven numbers, that

*Veins and  
sinuses.*

is,

is, some of them are placed alone, in a middle situation; others are disposed laterally on each side of the brain. The most ancient anatomists reckoned only four; to which we can now add four times as many.

29. These sinuses are in the duplicature of the dura mater; and their cavities are lined on the inside by particular very fine membranes. They may be enumerated in this manner. The great sinus of the falx or superior longitudinal sinus, which was reckoned the first by the ancients. Two great lateral sinuses, the second and third of the ancients. The sinus called *torcular Herophili*, the fourth of the ancients. The small sinus of the falx or inferior longitudinal sinus. The posterior occipital sinus, which is sometimes double. Two inferior occipital sinuses, which form a portion of a circle, and may likewise be called *the inferior lateral sinuses*. Six sinus petrosi, three on each side, one anterior, one middle or angular; and one inferior. The two inferior, together with the occipital sinuses, complete a circular sinus round the great foramen of the Os Occipitis. The inferior transverse sinus. The superior transverse sinus. Two circular sinuses of the sella sphenoidalis; one superior and one inferior. Two sinus cavernosi, one on each side. Two orbitary sinuses, one on each side.

30. All these sinuses communicate with each other, and with the great lateral sinuses by which they discharge themselves into the internal jugular veins, which are only continuations of these lateral sinuses. They likewise unload themselves partly into the vertebral veins, which communicate with the small lateral or inferior occipital sinuses; and partly into the external jugular veins, by the orbitary sinuses, which communicate with the venæ angulares, frontales, nasales, maxillares, &c. as the lateral sinules likewise communicate with the venæ occipitales, &c.

31. Thus the blood which is carried to the dura mater, &c. by the external and internal carotid, and by the vertebral arteries, is returned to the heart by the external and internal jugular and vertebral veins; so that when the passage of the blood is obstructed in any particular place, it finds another way, by virtue of these communications, though not with the same ease. This observation is of consequence in relation

not only to obstructions, but to the different situations of the head.

32. The great sinus of the falx reaches from the connection of the ethmoidal crista with the Os Frontis, along the upper edge of the falx, all the way to the posterior edge of the transverse septum, where it ends by a bifurcation in the great lateral sinuses. It is very narrow at its anterior extremity, and from thence becomes gradually wider all the way to its posterior extremity.

33. The cavity of this sinus is not cylindrical, but triangular, having in a manner three sides, one superior, parallel to the cranium, and two lateral inclined to the plane of the falx. The upper side is formed by the external lamina of the dura mater, and through the middle of its breadth a kind of fine raphe or suture runs from one end to the other.

34. The two lower or lateral sides are productions of the internal lamina, which having parted from the external, are inclined toward each other, and then unite; forming first the sinus, and afterwards the duplicature of the falx. This sinus is lined interiorly by a fine proper membrane, which forms likewise a kind of raphe or suture along the bottom of the sinus, that is, along the union of the two lateral sides.

35. In this sinus we observe several openings and several ligamentary fræna. The openings are orifices of veins, the smallest of which belong to the dura mater, the largest to the brain. The veins of the brain enter the sinus, for the most part, obliquely from behind forward, after they have run about a finger's breadth in the duplicature of the dura mater.

36. It has been thought that the arteries of the dura mater discharged themselves immediately into the sinuses, because injections made by the arteries, or a hog's bristle thrust into them, have been found to pass into these sinuses. But, on a more close examination, it has been discovered that the injections passed from the arteries into the veins, and from thence into the sinuses, through the small orifices already mentioned; and that the hog's bristle pierced the sides of the artery, which near the sinuses are very thin.

37. This mistake gave rise to another, that the dura mater had no veins; and what confirmed it was, that the arteries of the dura mater cover the veins so entirely, that the edges of the veins are hardly perceivable on either side of the arteries.

There



There are however some places where the veins being broader than the arteries, their two edges are seen on each side of the arteries like capillary vessels. These veins are for the most part branches of the sinuses, and the small trunks of some of them open into the head of the vena jugularis interna. We may easily be satisfied that the arteries on both sides of the dura mater communicate with each other above the falx, either by injecting or blowing into them.

38. The internal fræna of this great sinus appear to be tendinous, and to be designed to prevent the too great dilatation of the sinus by the blood. They vary however in different subjects, and do not always reach from one side to the other. It has been pretended that glands have been found there; but we ought to take care not to mistake for such, certain small corpuscles which are not the products of diseases.

39. The inferior sinus of the falx is situated in the lower edge of its duplicature, being very narrow, and as it were flattened on both sides. It communicates immediately with the fourth sinus of the ancients; and in some subjects seems even to be a continuation thereof. It likewise communicates with the great or superior sinus, by small veins which go from one to the other, and with the veins of the cerebrum by the same means.

40. The lateral sinuses represent two large branches of the superior longitudinal sinus, one going to the right hand, the other to the left, along the great circumference of the transverse septum, all the way to the basis of the apophysis petrosa of the *Ossa Temporum*. From thence they run down, having first taken a large turn and then a small one; and being strongly fixed in the lateral grooves of the basis cranii, they follow the course thereof all the way to the foramina lacera and fossulæ of the jugular veins.

41. They do not always arise by an equal and symmetrical bifurcation of the superior longitudinal sinus; for in some subjects, one of the lateral sinuses appears to be a continuation of the longitudinal, and the other, to be a branch from it. This variety may happen on either side; and in a word, we sometimes find one of these sinuses higher or lower, larger or smaller than the other.

42. The cavity of these lateral sinuses is likewise triangular,

lar, and furnished with a proper membrane and with fræna; and it has also the small venal openings, which indeed are common to it, not only with the longitudinal sinus, but with most part of the others. The posterior or outer side of this cavity, is formed by the external lamina of the dura mater, and the other two by the internal lamina.

43. As these two sinuses go out by the posterior portions of the openings of the basis cranii, called *foramina lacera*, they are dilated into a kind of bag, proportioned to the fossulæ of the venæ jugulares, where they terminate in these veins.

44. Near the concurrence of the superior longitudinal and lateral sinuses, we observe an opening (sometimes double) which is the orifice of a sinus situated along the union of the falx and transverse septum. It does not always end directly at the lower part of the superior sinus, but sometimes opens at the beginning of one of the lateral sinuses, especially when the bifurcation is not equal; and in this case it often terminates in that lateral sinus, which appears like a branch from the common trunk of the superior and other lateral sinus.

45. This sinus has been named *torcular Herophili*, from an ancient author, who imagined that the blood was in a manner in a press, at the union of these four sinuses. Its diameter is but small, and it forms a kind of bifurcation with the inferior longitudinal sinus, and with a vein of the cerebrum which is sometimes double, called *vena magna Galeni*,

46. The cavernous or lateral sinuses of the Os Sphenoides are reservatories of a very particular kind, containing not only blood, but considerable vessels and nerves, as we shall see hereafter; and likewise a spongy or cavernous substance full of blood, much like that of the spleen or corpus cavernosum of the urethra.

47. We observe some nervous filaments which go to the dura mater, from the trunk of the fifth pair, at the entry of the cavernous sinus; and from the common trunk of the eighth pair and nervus accessorius or spinalis, as they pass through the foramen lacrum. The small tubercles sometimes found on the lateral sides of the longitudinal sinus of the falx, deserve still to be examined before we can determine any thing about them. The whole inside of the dura mater is moistened in the same manner as the peritonæum and pleura.

*Nerves and glands.*

48. The

48. The prominent fibres intersecting each other in different manners which appear on the inside of the dura mater, especially near the falx and transverse septum, and which have been taken for a kind of fleshy fibres seem to be only ligamentary and elastic. The universal adhesion of this membrane to the cranium, proves that it can have no particular motion, and consequently that such fleshy or muscular fibres would be altogether useless. This adhesion was plainly demonstrated by Vesalius, Riolan, &c. long before Roonhuyfen.

§ 2. *Pia Mater.*

49. This membrane surrounds the whole mass of the brain more particularly than the dura mater. It adheres very closely to the brain, and is connected to the dura mater only by the veins which open into the sinuses as has been already said.

*Situation in general.*

50. The pia mater is made up of two very fine laminæ, the outermost of which covers pretty uniformly all the convex surface of the brain, and lines in the same manner all the concave or inner surface of the dura mater. The internal lamina forms a great number of plicæ, duplicatures, and septa, which insinuate themselves into all the folds and circumvolutions, and between the different strata of the cerebrum and cerebellum.

*Structure.*

51. The two laminæ of the pia mater are not so closely united as those of the dura mater, being connected only by a cellular substance, which accompanies them through their whole extent, except at some places of the basis of the cerebrum, &c. where the internal lamina continuing its insertions, the external remains uniformly stretched over the prominent parts, the interstices of which are entirely separated from the other lamina without any cellular substance between them. These separate portions of the external lamina have made it be looked upon as a third membrane of the brain, distinct from the pia mater; and it has been named *membrana arachnoides*, from its resemblance to a cobweb in delicacy of texture.

52. In each of these laminæ of the pia mater, we discover another kind of fine duplicature, which contains vessels, as I have demonstrated in my private courses; but these small vessels are hardly perceivable without the help of an injection,

or



or of a great inflammation. The cellular substance does not only accompany the two laminæ through their whole common extent, in the manner already said, but also the internal lamina in particular through all its duplicatures and septa. This we discover by blowing through a small pipe cautiously introduced between the two laminæ, so as not to offend any of the parts near it, in the manner which I demonstrated publicly in the year 1726, in the dissection which I performed myself at the physic-schools, after the example of the great Riolan.

### § 3. Cerebrum.

53. The cerebrum properly so called, is a kind of medullary mass, of a moderate consistence, and of a greyish colour on the outer surface, filling all the superior portion of the cavity of the cranium, or that portion which lies above the transverse septum. The upper part of the cerebrum is of an oval figure like half an egg cut lengthwise, or rather like two quarters of an egg cut lengthwise, and parted a little from each other. It is flatter on the lower part, each lateral half of which is divided into three eminences, called *lobes*, one anterior, one middle, and one posterior.

54. The substance of the cerebrum is of two kinds, distinguished by two different colours; one part of it, which is softest, being of a greyish or ash colour; the other, which is more solid, being very white. The ash-coloured substance lies chiefly on the outer part of the cerebrum like a kind of cortex, from whence it has been named *substantia corticalis* or *cineria*. The white substance occupies the inner part, and is named *substantia medullaris*, or simply *substantia alba*.

55. The cerebrum is divided into two lateral portions, separated by the falx, or great longitudinal septum of the dura mater. They are generally termed *hemispheres*, but they are more like quarters of an oblong spheroid. Each of these portions is divided into two extremities, one anterior, and one posterior, which are termed the *lobes of the cerebrum*, between which there is a large inferior protuberance which goes by the same name; so that

that in each hemisphere there are three lobes, one anterior, one middle, and one posterior.

56. The anterior lobes lie upon these parts of the Os Frontis which contribute to the formation of the orbits and of the frontal sinuses, commonly called the *anterior fossæ of the basis cranii*. The posterior lobes lie on the transverse septum; and the middle lobes, in the middle or lateral fossæ of the basis cranii.

57. Each lateral portion of the cerebrum has three sides, one superior, which is convex, one inferior, which is uneven, and one lateral, which is flat, *Sides and inequalities.* and turned to the falx. Through the whole surface of these three sides we see inequalities or windings like the circumvolutions of intestines, formed by waving streaks or furrows very deep and narrow, into which the septa or duplicatures of the pia mater insinuate themselves, and thereby separate these circumvolutions from each other.

58. Near the surface of the cerebrum, these circumvolutions are at some distance from each other, representing serpentine ridges; and in the interstices between them, the superficial veins of the cerebrum are lodged, between the two laminæ of the pia mater, from whence they pass into the duplicature of the dura mater, and so open into the sinuses.

59. These circumvolutions are fixed through their whole depth to the septa or duplicatures of the pia mater, by an infinite number of very fine vascular filaments, as may be seen by pulling the circumvolutions a little asunder with the fingers.

60. When they are cut transversely, we observe that the substantia alba lies in the middle of each circumvolution, so that there is the same number of internal medullary circumvolutions as of external cortical ones; the first representing white laminæ invested by others of an ath colour; but the cortical substance is in many places thicker than the medullary.

61. The anterior and middle lobes of the cerebrum on each side are parted by a deep narrow sulcus, which ascends obliquely backward, from the temporal ala of the Os Sphenoides to near the middle of the Os Parietale; and the two sides of this division have each their particular ridges and circumvolutions, which gives a very great extent

*Figure.*

to

to the cortical substance. This sulcus is termed *fissura magna Silvii*, or simply *fissura cerebri*.

62. Having cut off the falx from the crista galli, and turned it backward; if we separate gently the two lateral parts or hemispheres of the cerebrum, we see a longitudinal portion of a white convex body which is named *corpus callosum*. It is a middle portion of the medullary substance, which under the inferior sinus of the falx, and also a little toward each side, is parted from the mass of the cerebrum, to which it is simply contiguous from one end of that sinus to the other, so that, at this place, the edge of the inside of each hemisphere only lies on the corpus callosum, much in the same manner as the anterior and posterior lobes lie on the dura mater. Both extremities of this medullary body terminate by a small edge bent transversely downward.

63. The surface of the corpus callosum is covered by the pia mater, which runs in between the lateral portions of this body, and the lower edge of each hemisphere. Along the middle of its surface from one end to the other, there is a kind of raphe formed by a particular intertexture of fibres which cross each other; for though these fibres appear to be transverse, yet they are really a little oblique, and those that come from the right side intersect those that come from the left. This raphe is made more perceivable by two small medullary cords which accompany it on each side, and adhere closely to the transverse fibres.

64. The corpus callosum becomes afterwards continuous on each side, with the medullary substance, which, through all the remaining parts of its extent, is entirely united with the cortical substance, and together with the corpus callosum, forms a medullary arch or vault of an oblong or oval figure. To perceive this, the whole cortical substance, together with the medullary laminae mixed with it, must be cautiously and dexterously cut off in the same direction with the convexity of the cerebrum. After which we will observe a medullary convexity much smaller than that which is common to the whole cerebrum, but of the same form; so that it appears like a medullary nucleus of the cerebrum, especially when we consider it together with the medullary substance of the inferior part



part or basis of the cerebrum. And from thence M. Vieussiens took occasion to name this nucleus the *centrum ovale*.

65. Under this arch are two lateral cavities, much longer than they are broad, and very shallow, separated by a transparent medullary septum, of which hereafter. *Ventriculi laterales.* These cavities are generally named *the anterior superior ventricles of the cerebrum*, to distinguish them from two other smaller cavities which are situated more backward, as we shall see presently; but the name of *lateral* or *great ventricles* given them by Steno, is more proper than either of the other two.

66. The lateral ventricles are broad, and rounded at these extremities which lie next the transparent septum. They go from before backward, contracting in breadth, and separating from each other gradually in their progress. Afterwards they bend downward, and return obliquely from behind forward, in a course like the turning of a ram's horn, and terminate almost under their superior extremities, only a little more backward and outward.

67. At the place where they begin to bend in order to run downward and then backward, there is on each side a particular elongation which runs from before backward, and terminates in a triangular pointed cavity turned a little inward, the two points resembling horns. These ventricles are every where lined with a thin membrane.

68. The transparent partition or septum lucidum, as it is commonly called, lies directly under the raphe or suture of the corpus callosum, of which it is a continuation, and a kind of duplicature. *Septum lucidum.* It is made up of two medullary laminæ, more or less separated from each other by a narrow medullary cavity, sometimes filled with a serous substance. This cavity, in some subjects, reaches a great way backward; and I am apt to think, communicates with the third ventricle, of which hereafter.

69. The septum lucidum is united, by its lower part, to the anterior portion of that particular medullary body, called improperly *the fornix* with three pillars, *Fornix.* because of some resemblance it is thought to bear to the arches of ancient vaults. It is in reality nothing but the corpus callosum, the lower side of which is like a hollow ceiling with three angles one anterior and two posterior; and three

edges, two lateral and one posterior. The lateral edges are terminated each by a large semicylindrical border, like two arches, which uniting at the anterior angle, form by their union what is called *the anterior pillar of the fornix*; and as they run backward separately toward the two posterior angles, they have then the name of *the posterior pillars*.

70. The anterior pillar being double is larger than either of the posterior; and the marks of this duplicity always remain. Immediately below the basis of this pillar we observe a large, white, short, medullary rope stretched transversely between the two hemispheres, and commonly called *the anterior commissure of the cerebrum*. It is to this pillar that the septum lucidum adheres; but it has no total adhesion below, and therefore the two lateral ventricles communicate with each other. The posterior pillars are bent downward, and continued through the lower portions of the ventricles all the way to their extremities, resembling a ram's horn, which is a name that has been given to them. They diminish gradually in thickness during this course, and at their outsides they have each a small, thin, flat, collateral border, to which the name of *corpora fimbriata* is owing.

71. The inferior surface of the triangular ceiling, which lies between these arches, is full of transverse, prominent, medullary lines; for which reason the ancients called it *psaloides* and *lyra*, comparing it to a stringed instrument, something like what is now called a *dulcimer*.

72. The fornix being cut off and inverted, or quite removed, we see first of all a vascular web, called *Eminences. plexus choroides*, and several eminences more or less covered by the expansion of that plexus. There are four pairs of eminences which follow each other very regularly, two large and two small. The first two great eminences are named *corpora striata*; and the second, *thalami nervorum opticorum*. The four small eminences are closely united together; the anterior being called *nates*, and the posterior, *testes*; but it would be better to call them simply *anterior* and *posterior tubercles*. Immediately before these tubercles there is a single eminence, called *glandula pinealis*.

73. The *corpora striata* got that name, because in scraping them with the knife we meet with a great number of white and ash-coloured lines alternately disposed,

disposed, which are only the transverse section of the medullary and cortical laminæ, mixed together in a vertical position in the basis of the cerebrum, as appears evidently by incisions made from above downward. These two eminences are of a greyish colour on the surface, oblong, roundish, pyramiform, and larger on the fore than on the back part, where they are narrow and bent.

74. They lie in the bottom of the superior cavity of the lateral ventricles, which they resemble in some measure in shape, their anterior parts being near the septum lucidum, from which they separate gradually as they run backward, and diminish in size. They are in reality the convex bottoms of the ventricles, and it is at the lower part of the interstice between the largest portions of them, that we observe the great transverse cord, named *the anterior commissure of the cerebrum*, which I mentioned already in describing the anterior pillar of the fornix callosus. This cord communicates more particularly with the bottom of the corpora striata, by a turn toward each side.

75. The thalami nervorum opticorum are so named, because these nerves arise chiefly from them. They are two large eminences placed by the side of each other, between the posterior portions or extremities of the corpora striata. Their figure is semispheroidal and a little oval; and they are of a whitish colour on the surface; but their inner substance is partly greyish and partly white, so that, in cutting them, we see streaks of different colours like those of the corpora striata.

*Thalami nervorum opticorum.*

76. These two eminences are closely joined together, and at their convex part they are so far united as really to become one body, the whitish outer substance being continued uniformly over them both. This substance is very thin, and falls to pieces only by the weight of the lateral parts of the brain, when taken out of the cranium. Therefore to learn the structure of these eminences, they must be examined in situ, and even there they must be handled very gently.

77. Immediately within this whitish common substance these two eminences are closely contiguous till about the middle of their thickness; and from thence they separate insensibly toward the bottom, where by the space left between them a particular canal is formed, named *the third ventricle*,



one extremity of which opens forward, the other backward, as we shall see hereafter. Some anatomists have mistaken the superficial connection of these eminences for the pons Varolii.

78. At the bottom these two eminences are elongated downward toward both sides, into two thick, round, whitish cords, which separate from each other like horns, by a large curvature; and afterwards by a small curvature turned forward in an opposite direction to the former, and representing the tip of an horn, they approach each other again. The size of these ropes diminishes gradually from their origin to their anterior reunion. I shall have occasion to mention them in another place in speaking of the optic nerves.

79. The tubercles are four in number, two anterior and two posterior; adhering together as if they made  
*Tubercula.* but one body situated behind the union of the thalami nervorum opti-  
corum. They are transversely oblong; the anterior being a little more rounded, and broader or larger from before backward, than the posterior. Their surface is white, and their inner substance greyish. The names of *nates* and *testes* given to these tubercles are very impertinent, there being no resemblance between them and the things from whence these names are taken. I should like to call them *tubercula quadrigemina*; that term being used by anatomists on another like occasion, to express four small muscles lying near each other, and inserted round the great trochanter of the Os Femoris.

80. Directly under the place where the tubercles of one  
*Canalis medius.* side are united to those of the other side, lies a small middle canal, which communicates by its anterior opening with the third ventricle, under the thalami nervorum opti-  
corum, and by its posterior opening, with the fourth ventricle, which belongs to the cerebellum, as we shall afterwards see.

81. Where the convex parts of the two anterior tubercles join these posterior convex parts of the thalami nervorum opti-  
*Foramen commune posterius.* corum, an interstice or opening is left between these four convexities, which communicates with the third ventricle, and with the small middle canal. Instead of the ridiculous name of *anus*, which has been given to this opening, it may be called *foramen commune posterius*, to distinguish it from another, which

which shall be mentioned hereafter by the name of *foramen commune arterius*.

82. The glandula pinealis is a small soft greyish body, about the size of an ordinary pea, irregularly round, and sometimes of the figure of a *Glandula pinealis*. pine-apple, situated behind the thalami nervorum opticorum above the tubercula quadrigemina. It is fixed like a small button to the lower part of the thalami by two very white medullary pedunculi, which at the gland are very near each other, but separate almost transversely toward the thalami.

83. It seems to be mostly of a cortical substance, except near the footstalks, where it is something medullary. The footstalks are sometimes double, as if they belonged to the two anterior tubercles. This body adheres very close to the plexus choroides, by which it is covered, as we shall see hereafter; and it therefore requires some dexterity to separate it from the glandula, without altering its situation or breaking the pedunculi. This gland has been often found to contain gravel. Below the glandula pinealis there is a medullary transverse cord, called the *posterior commissure of the hemispheres of the cerebrum*.

84. Between the basis of the anterior pillar of the fornix, and the anterior part of the union of the optic thalami, lies a cavity or fossula named *infundibulum*. *Infundibulum*. It runs down towards the basis of the cerebrum, contracting gradually, and terminates in a straight course by a small membranous canal, in a softish body situated in the sella sphenoidalis, named *glandula pituitaria*. The infundibulum opens above, immediately before the optic thalami, by an oval hole named *foramen commune arterius*, and consequently communicates with the lateral ventricles.

85. At the lower part of the thalami nervorum opticorum, directly under their union, lies a particular natural canal, called the *third ventricle of the cerebrum*. *The third ventricle*. I call it a *natural canal*, that we may not mistake for it, an accidental fissure which lies between the thalami in cerebra taken out of the cranium, as I have already said.

86. This canal opens forward into the infundibulum under the foramen commune arterius, by which it likewise communicates with the lateral ventricles. It opens backward

ward under the foramen commune posterius, between the thalami and tubercula quadrigemina, opposite to the small middle canal which goes to the cerebellum.

87. The plexus choroides is a very fine vascular texture, consisting of a great number of arterial and venal ramifications, partly collected in two loose fasciculi, which lie on each lateral ventricle, and partly expanded over the neighbouring parts, and covering in a particular manner the thalami nervorum opticorum, glandula pinealis, tubercula quadrigemina, and the other adjacent parts both of the cerebrum and cerebellum, to all which it adheres.

88. In each lateral portion of this plexus we observe a venal trunk, the ramifications of which are spread through the whole extent of the two portions. Near the glandula pinealis these two trunks approach each other, and uniting behind that gland, they open into the torcular or fourth sinus of the dura mater. When we blow into one of these trunks toward the plexus, the air passes into all its ramifications; and in some subjects, these two veins form one trunk which opens into the sinus.

89. The ventricular or loose portions of the plexus, often appear to contain a great number of tubercles like glands, which in the natural state are extremely small, but grow bigger in diseases. To be able to examine them as we ought, the loose portions must be made to swim in clear water, and be there carefully expanded. Then by the help of a microscope we will see these tubercles in the natural state, like small folliculi or little bags more or less flattened.

90. Besides this vascular web or plexus of the septum lucidum; the sides of the fornix; of the eminences, ventricles, canals, and infundibulum, are all covered by a very fine membrane, in which, by injections or inflammations, we discover a great number of very fine vessels. This membrane is in a manner a continuation of the plexus, and that seems to be a detachment from the pia mater. By the same means we likewise discover an extremely thin membrane on the insides of the duplicature of the septum, though, in some subjects, these sides touch each other.

*Glandula pituitaria.*

91. The pituitary gland is a small spongy body lodged in the sella sphenoidalis between



between the sphenoidal folds of the dura mater. It is of a singular kind of substance, which seems to be neither medullary nor glandular. On the outside it is partly greyish, and partly reddish, and white within. It is transversely oval or oblong, and on the lower part in some subjects it is divided by a small notch into two lobes, like a kidney-bean. It is covered by the pia mater as by a bag, the opening of which is the extremity of the infundibulum, and it is surrounded by the small circular sinuses which communicate with the sinus cavernosi.

#### § 4. *Cerebellum.*

92. The cerebellum is contained under the transverse septum of the dura mater. It is broader laterally than on the fore or backsides, flattened on the upper side, and gently inclined both ways, answerable to the septum which serves it as a kind of tent or ceiling. On the lower side it is rounder, and on the backside it is divided into two lobes, separated by the occipital septum of the dura mater.

*Situation and figure.*

93. It is made up, like the cerebrum, of two substances, but it has no circumvolutions on its surface. Its sulci are pretty deep, and disposed in such a manner as to form thin flat strata, more or less horizontal, between which the internal lamina of the pia mater insinuates itself by a number of septa equal to that of the strata.

*Structure.*

94. Under the transverse septum, it is covered by a vascular texture, which communicates with the plexus choroides. It has two middle eminences called *appendices vermiformes*, one anterior and superior which is turned forward, the other posterior and inferior which goes backward. There are likewise two lateral appendices, both turned outward. They are termed *vermiformes*, from their resemblance to a large portion of an earth-worm.

95. Besides the division of the cerebellum into lateral portions or into two lobes, each of these lobes seems to be likewise subdivided into three protuberances, one anterior, one middle or lateral, and one posterior; but they are not in all subjects equally distinguished either by their convexity or limits; but they may always be distinguished by the direction of

of their strata, those of the middle and anterior protuberance being less transverse than the posterior.

96. When we separate the two lateral portions or lobes, having first made a pretty deep incision; we discover first of all the posterior portion of the medulla oblongata, of which hereafter; and in the posterior surface of this portion, from the tubercula quadrigemina, all the way to the posterior notch in the body of the cerebellum, and a little below that notch; we observe an oblong cavity which terminates backward like the point of a writing pen. This cavity is what is called the *fourth ventricle*.

97. At the beginning of this cavity immediately behind the small common canal which lies under the tubercles, we meet with a thin medullary lamina, which is looked upon as a valve between that canal and the fourth ventricle. A little behind this lamina, the cavity grows wider towards both hands, and then contracts again to its first size. It is lined interiorly by a thin membrane, and seems oftentimes to be distinguished into two lateral parts, by a kind of small groove, from the valvular lamina to the point of the calamus scriptorius.

98. This membrane is a continuation of that which lines the small canal, the third ventricle, infundibulum, and the two great ventricles. To be able to see the fourth ventricle in its natural state, in which it is narrowest, it must be laid open while the cerebellum remains in the cranium, and in order to that, the Os Occipitis must be sawed very low down.

99. On each side of this ventricle the medullary substance forms a trunk which expands itself in form of laminæ through the cortical strata. We discover these medullary laminæ according to their breadth, by cutting the cerebellum in slices almost parallel to the basis of the cerebrum; but if we cut one lobe of the cerebellum vertically from above downward, the medullary substance will appear to be dispersed in ramifications through the cortical substance. These ramifications have been named *arbor vitæ*, and the two trunks from whence these different laminæ arise, are called *pedunculi cerebelli*.

100. We cannot go on with the description of the other middle parts of the basis of the cerebellum, before that of the middle parts of the basis of the cerebrum, because these two kinds of parts are united, and jointly form the medulla oblongata.

longata. I shall only add here, that the strata of both substances of the cerebellum are not always of the same extent in the same portions or protuberances of each lobe. This appears merely by viewing the convex or outer surface of the cerebellum; for there we see, at different distances, some cortical strata shorter than others, and likewise that the extremities of the short strata diminish gradually in thickness till they are quite lost between two long ones.

101. If we make a small hole in the external lamina of the pia mater over one of the lobes of the cerebellum, without touching the inner lamina, and then blow into the cellular substance by which these two laminæ are connected, through a small pipe introduced into the hole; the air will gradually swell that substance, and separate the strata more or less equally from each other, through their whole extent, and we will see at the same time the disposition of all the membranous septa or duplicatures of the internal lamina of the pia mater, with the numerous distribution of the fine blood-vessels which run upon it, especially after a lucky injection, or in an inflammatory state of these membranes.

§ 5. *Medulla oblongata.*

102. The medulla oblongata is a medullary substance situated from before backward in the middle part of the bases of the cerebrum and cerebellum without any discontinuation, between the lateral parts of both these bases; and therefore it may be looked upon as one middle medullary basis common to both cerebrum and cerebellum, by the reciprocal continuity of their medullary substances, through the great notch in the transverse septum of the dura mater; which common basis lies immediately on that portion of the dura mater which lines the basis of the cranium. The medulla oblongata is therefore justly esteemed to be a third general part of the whole mass of the brain, or as the common production or united elongation of the whole medullary substance of the cerebrum and cerebellum.

103. It is extremely difficult, if not altogether impossible, to examine or demonstrate it as we ought, in its natural situation; but we are obliged to do both on a brain inverted; and in this instance, the direction I gave in the description



of the skeleton, N<sup>o</sup> 186. 187. concerning the method of examining and demonstrating the basis cranii, cannot have place. However, to prevent false ideas either in viewing ourselves, or in shewing to others the medulla oblongata thus inverted, it is very necessary often to call to mind that all that appears superior in that situation is inferior in the natural state.

104. The lower side of the medulla oblongata in an inverted situation, presents to our view several parts which are in general either medullary productions, trunks of nerves, or trunks of blood-vessels.

105. The chief medullary productions are these; the large or anterior branches of the medulla oblongata; which have likewise been named *crura anteriora*, *femora* and *brachia medullæ oblongatæ*, and *pedunculi cerebri*: the transverse protuberance called likewise *processus annularis* or *pons Varolii*: the small or posterior branches called *pedunculi cerebelli*, or *crura posteriora medullæ oblongatæ*: the extremity or cauda of the medulla oblongata; with two pairs of tubercles, one of which is named *corpora olivaria*, the other *corpora pyramidalia*; and to all these productions we must add a production of the infundibulum and two medullary papillæ.

106. The great branches of the medulla oblongata are two very considerable medullary fasciculi, the anterior extremities of which are separated, and the posterior united, so that taken both together, they represent a Roman V. These fasciculi are flat, much broader before than behind; their surfaces being composed of several longitudinal and distinctly prominent medullary fibres. Their anterior extremities seem to be lost at the lower part of the corpora striata; and it is for that reason that they are looked upon as the pedunculi of the cerebrum.

107. The transverse, annular, or rather semi-annular protuberance is a medullary production, which seems at first sight to surround the posterior extremities of the great branches; but the medullary substance of this protuberance is in reality intimately mixed with that of the two former. Varolius an ancient Italian author, viewing those parts in an inverted situation, compared the two branches to two rivers, and the protuberance to a bridge over them both, and from thence it has the name of *pons Varolii*. Its surface is transversely streak-

ed,

ed, and it is divided into two lateral parts, by a very narrow, longitudinal depression, which does not penetrate into its substance.

108. The small branches of the medulla oblongata are lateral productions of the transverse protuberance, which by their roots seem to encompass that medullary portion in which the fourth ventricle or calamus scriptorius is formed. They form in the lobes of the cerebellum on each side, these medullary expansions, a vertical section of which shews the white ramifications, commonly called *arbor vitæ*; and they may be justly enough styled *pedunculi cerebelli*.

109. The extremity is no more than the medulla oblongata contracted in its passage backward to the anterior edge of the great foramen of the Os Occipitis, where it terminates in the medulla spinalis; and in this part of it several things are to be taken notice of. We see first of all, four eminences, two named *corpora olivaria*, and the other two *corpora pyramidalia*. Immediately afterwards, it is divided into two lateral portions by two narrow grooves, one on the upper side, the other on the lower. They both run into the substance of the medulla, as between two cylinders, flattened on that side by which they are joined together.

110. When we separate these ridges with the fingers, we observe a crucial intertexture of several small medullary chords, which go obliquely from the substance of one lateral portion into the substance of the other. M. Petit, member of the royal academy of sciences and doctor of physick, is the author of this discovery, by which we are enabled to explain several phænomena both in physiology and pathology, of which in another place.

111. The *corpora olivaria* and *pyramidalia* are whitish eminences situated longitudinally near each other on the lower side of the extremity or cauda, immediately behind the transverse or annular protuberances. The *corpora olivaria* are in the middle, so that the interstice between them, which is only a kind of superficial groove, answers to the inferior groove of the following portion.

112. The *corpora pyramidalia* are two lateral eminences depending on the *olivaria*. Willis gave the name of *pyramidalia* to what I have called *olivaria*, after the late M. Duvcrney in his treatise of the organ of hearing. These four emi-

nences are situated on the lower half of the medulla; which observation I here repeat to make it be remembered, that, in all the figures and demonstrations, these parts are represented as superior, which in their natural situation are inferior. Thus these eminences are under the fourth ventricle, and under the pedunculi cerebelli.

113. The tubercula mammillaria which are situated very near the production of the infundibulum, have been taken for glands; probably because of their greyish inner substance, which however does not seem to be any wise different from that of several other eminences of the medulla oblongata. And for that reason I chuse rather to call them from their figure *tubercula mammillaria*, than *papillæ medullares*.

114. These tubercles seem to have some immediate relation to the roots or bases of the anterior pillar of the fornix; so that they might be named, as M. Santorini has done, *the bulbs of these roots*, though they appear to be likewise partly a continuation of other portions of the cortical and medullary substance, of a particular texture.

115. The beak or tube of the infundibulum is a very thin production from the sides of that cavity; and it is strengthened by a particular coat given to it by the pia mater. It is bent a little from behind forward, toward the glandula pinealis, and afterwards expands again round this gland.

116. The membrana arachnoides, or external lamina of the pia mater appears to be very distinctly separated from the internal lamina, in the interstices between all these eminences on the lower side of the medulla oblongata, without any visible cellular substance between them. The internal lamina adheres much more to the surface of these interstices than to that of the eminences. The external lamina is as it were buoyed up by the eminences, and equally stretched between their most prominent parts, to which it sticks very close; and in this respect, the roots or great cornua of the optic nerves may be joined to these eminences.

117. We must observe in general concerning the eminences of the medulla oblongata, that those which are medullary on their outsides or surfaces, are interiorly either entirely cortical, or partly cortical and partly medullary, or formed by a singular mixture of these two substances, which still remains



to be unfolded, as well as many other particularities observable in examining the internal structure of the brain.

118. From this common portion of the cerebrum and cerebellum, arise almost all the nerves which go out of the cranium, through the different foramina by which its basis is perforated. It likewise produces the medulla spinalis, which is no more than a common elongation of the cerebrum and cerebellum, and of their different substances; and therefore the medulla oblongata may justly be said to be the first origin or primitive source of all the nerves, which go out through the spina dorſi, and conſequently of all the nerves of the human body.

§ 6. *Medulla spinalis.*

119. The medulla spinalis is only an elongation of the extremity of the medulla oblongata; and it has its name from its being contained in the bony canal of the spina dorſi. It is conſequently a continuation or common appendix of the cerebrum and cerebellum, as well becauſe of the two ſubſtances of which it is compoſed, as becauſe of the membranes by which it is inveſted.

120. In the deſcription of the freſh bones, N<sup>o</sup> 316. 317. 318. 319. I mentioned a ligamentary tube which lines the inner ſurface of this bony canal from the great occipital foramen to the Os Sacrum, repreſenting a very long flexible funnel. I likewiſe mentioned the yellowiſh and very elatiſtic ligaments that lie in the great poſterior notches of all the vertebræ, and adhere very cloſely to the ligamentary tube.

121. The dura mater, after it has lined the whole internal ſurface of the cranium, goes out by the great occipital foramen, and forms a kind of funnel, in its progreſs downward, through the bony canal of the vertebræ. As it goes out at the occipital hole, it joins the beginning of the ligamentary funnel already mentioned, and adheres very ſtrongly to it. That portion of the pericranium which terminates exteriorly at the edge of the great foramen, joins the funnel likewiſe; which by all theſe ſucceſſions becomes very ſtrong and capable of reſiſting the greateſt violences.

122. This adheſion of the dura mater to the ligamentary funnel, is gradually diſcontinued below the firſt vertebra, and  
from

from thence the dura mater forms a separate tube, which runs down in the bony canal all the way to the Os Sacrum, the capacity of it answering to that of the canal; but it does not adhere closely to the sides, as it does to that of the cranium. It is surrounded by a slimy substance, which, near the lower end of the canal, resembles fat.

123. The spinal marrow is made up of a cortical and medullary substance, as the cerebrum and cerebellum, but with this difference, that the ash-coloured substance lies within the other; and in a transverse section of this medulla the inner substance appears to be of the figure of an horse shoe or of the Os Hyoides; the convex side being turned forward, and the extremities or cauda backward.

124. The body of the medulla spinalis runs down all the way to the first vertebra of the loins, where it terminates in a point. The size of it is proportionable to that of the bony canal, so that it is larger in the vertebræ of the neck than those of the back. It is a little flattened on the fore and back sides; so that we may distinguish in it two sides, one anterior, the other posterior, and two edges. It is likewise in a manner divided into two lateral halves by a groove, which runs along the middle of each side, being a continuation of those in the extremity of the medulla oblongata.

125. Each lateral portion sends off from both the fore and back sides, between the grooves and the edges, at different distances, flat fasciculi of nervous filaments turned toward the nearest edge. The anterior and posterior fasciculi having got a little beyond the edge of the medulla, unite in pairs, and form on each side a kind of knots called *ganglions* by anatomists, each of which produces a nervous trunk. These ganglions are made up of a mixture of cortical and medullary substance, accompanied by a great number of small blood-vessels.

126. The dura mater which invests the medulla sends out on each side the same number of vaginæ, as there are ganglions and nervous trunks. These vaginæ are productions of the external lamina; the internal lamina which is very smooth and polished on the inside, being perforated by two small holes very near each other, where each vagina goes off, through which holes the extremities of each anterior and posterior

terior fasciculus are transmitted; and immediately after their passage through the internal lamina, they unite.

127. The triangular spaces left between the anterior and posterior fasciculi and edge of the medulla, are filled from one extremity to the other by an indented ligament, very thin and shining, having the same number of indentations as there are pairs of fasciculi. It is fixed at different distances to the edge of the medulla, from whence it sends filaments to the internal lamina of the dura mater, by which the anterior fasciculi are distinguished from the posterior.

128. The membrana arachnoides is here very distinct from the internal lamina of the pia mater; so that, by blowing through a hole made in the arachnoides, it will swell from one end to the other, like a transparent gut. The internal lamina, called in this place simply the *pia mater*, adheres very closely to the medulla spinalis, and sends many productions and septa through its substance. When we blow through a hole made in the pia mater, through the substance of one lateral portion of the medulla, the air penetrates through the whole, and the pia mater which covers the other lateral portion, is separated from it.

129. The membrana arachnoides adheres here more closely to the pia mater at the lower than at the upper part, being in a manner suspended by the indented ligament which runs along both edges of the medulla, and is fixed by a filament to the internal lamina of the dura mater in each interstice between the nervous fasciculi, as has been already said. It also gives off elongations in the same manner as the dura mater to each nervous trunk or rope, as we shall see hereafter.

§ 7. *The nerves of both medullæ, from their origin to their going out of the cranium.*

130. I observed in the beginning of the description of the nerves, that they arise either from the medulla oblongata or spinalis; that they go out in fasciculi disposed in pairs; that ten pairs are reckoned to belong to the medulla oblongata, of which nine go out through the foramina of the cranium, and the tenth arises from the extremity of this medulla as it passes through the great occipital hole; and lastly, that about thirty pairs were reckoned to belong to the medulla spinalis,



nalis, of which seven pass through the lateral notches of the vertebræ cervicis, twelve through those of the back, five through those of the loins, and five or six through the anterior holes of the Os Sacrum, and one at the sides of the Os Coccygis.

131. My design is here principally to mention some particular observations about the nerves, while they remain within the cranium, the rest of their course through the whole body being already sufficiently described; and I beg the reader first of all to review the idea I gave in that description, of the general division and original disposition of all the nerves which come either from the medulla oblongata or spinalis.

132. The first pair of nerves that arise from the medulla oblongata are the olfactory, anciently called *Nerves of the medulla oblongata.* *processus mammillares.* These are two very flat and soft medullary ropes, each arising first by medullary fibres from the outside of the lower part of the corpora striata, between the anterior and middle lobe, on each side of the cerebrum, and afterwards by another filament more internally, and by a third which is more posterior and very long. They run under the anterior lobes of the cerebrum, being lodged in two superficial grooves in the basis of these lobes, and lying immediately on the dura mater, from the clinoid apophyses to the Os Ethmoides.

133. They are first of all considerably incurvated from without inwards or toward each other, and having reached near the backside of the Os Ethmoides, they run for a small space, parallel to and at some distance from each other. Backward they are very thin, but they gradually increase in bulk in their course forward, toward each side of the crista of the ethmoidal bone, where they terminate in elongated papillæ, the substance of which appears to be softer and less white than that of the ropes.

134. These papillæ lie on the two sides of the lamina cribrosa, and send down a nervous filament into each hole of that lamina. At the same place, the dura mater sends off the same number of vaginæ which invest and accompany the nervous filaments and their ramifications on the internal parts of the nose.

135. I have already related the origin of the second pair or optic nerves, from the eminences called *thalami nervorum optidorum*;

*opticorum*; and I have described their great curvature, and traced them all the way to their reunion, which happens immediately before the superior part of the glandula pituitaria, and consequently before the beak or production of the infundibulum. The internal carotids run upon the outsides of these nerves, immediately after their union, and before they pass through the foramina optica.

136. Besides their origin from the optic thalami these nerves have likewise a kind of communication with the tubercula quadrigemina anteriora by very fine filaments, one extremity of which is lost in the tubercles, the other in the roots of the great arches or bodies of the optic nerves. The internal structure of these nerves seems to change at their entrance into the optic holes, as we shall see in another place.

137. The union of these nerves by the small curvatures of their cornua, is very difficult to be unfolded in human bodies. This union is commonly found to be very close, but, in some subjects, it seems to be no more than a strong adhesion; in others, to be partly made by an intersection or crossing of fibres. They have been found quite separate; and in other subjects one of them has been observed to be very much altered both in size and colour through its whole passage, the other remaining in its natural state.

138. The third pair, called *nervi motores oculi communes, oculares communes*, and *oculo-musculares*, arise from the union of the anterior edge of the great transverse protuberance, with the two great branches of the medulla oblongata. They pierce the dura mater behind the lateral parts of the posterior apophysis of the sella sphenoidalis, and pass afterwards each in the neighbouring sinus cavernosi, by the side of the carotid artery, and all the way to the broad portion of the superior orbitary fissure, where they are divided in the manner already said in describing the nerves.

139. The fourth pair, called *nervi trochleares, musculares obliqui superiores*, and most commonly *pathetici*, are very small and tender, and, in proportion, very long. They arise each behind the tubercula quadrigemina, and from the lateral part of the valviform expansion at the entry of the fourth ventricle. From thence they take their course forward all the way to the edge of the anterior extremities of the transverse sinus, where on each side they enter the duplicature of the dura ma-

Nov 29 1791  
 1791  
 1791

ter, and advancing into the sinus cavernosi, they accompany the third pair to the superior orbitary fissure.

140. The fifth pair, called *nervi innominati*, or *trigemini*, are at first large trunks arising chiefly from the lateral and posterior parts of the great transverse protuberance, and a little from the corpora olivaria and pyramidalia. They run down obliquely forward on the extremity of the upper or anterior side of the apophysis petroso, very near the side of the sella sphenoidalis, where they enter the duplicature of the dura mater and sinus cavernosi.

141. At their entry into the sinus, they form a kind of flat irregular ganglion, from which some filaments are sent off to the dura mater; and immediately afterward, each of them is divided into three great branches, one superior or anterior, one middle, and one inferior or posterior. The first branch, which may be termed *ocularis* or *ophthalmicus*, accompanies the nerves of the third and fourth pairs, to the superior orbitary fissure. The second, called *maxillaris superior*, goes out by the superior maxillary hole; and the third, named *maxillaris inferior*, by the inferior maxillary hole. As the great trunk of this nerve runs down, it perforates the membrana arachnoides, which at this place forms a kind of ceiling.

142. The sixth pair, named *motores oculorum externi*, *oculares* or *ophthalmici externi*, and *oculo-musculares externi*, are small nerves, but still not so small as the fourth pair; and I have sometimes found them double. They arise partly from the oblong inferior eminences, immediately behind the transverse protuberance, and partly from this protuberance; and passing immediately under it, they pierce the dura mater behind the occipital symphysis of the sphenoidal bone.

143. They run on each side in the duplicature of the dura mater to the cavernous sinus; and having entered that sinus, each of them accompanies the first branch of the fifth pair to the superior orbitary fissure. In this course they communicate with the first branch just mentioned, and are increased on the forepart by a filament or two, which arise from the great sympathetic nerve, and run up with the carotid.

144. The seventh pair, named *auditorii*, arise from the lateral and posterior part of the transverse protuberance, near the



the pedunculi of the cerebellum, by two cords, one small and solid, the other large and soft, which from thence is called *portio mollis*, and the first, *portio dura*, or, as I have named it, *nervus sympatheticus minimus*. The two nerves on each side accompany each other very closely, all the way to the internal foramen auditorium.

145. The eighth pair, named *par vagum, nervi vagi*, or *sympathetici medii*, arise from the posterior extremities of the large branches or crura of the medulla oblongata, from the transverse protuberance, and from the anterior part of the inferior oblong eminences behind the transverse protuberances; by numerous filaments, which all together make a broad band on each side, which runs toward the foramen lacerum, where it pierces the dura mater, and goes out through the anterior part of that hole, having been first joined by a nervous portion that runs up from the medulla spinalis through the great occipital foramen by the name of *nervus accessorius octavi paris*, or *nervus spinalis*. This additional nerve goes out with that of the eighth pair through the foramen lacerum, lying behind it, but distinguished from it by a membranous septum.

146. The ninth pair, called *nervi hypoglossi externi, hypoglossi majores*, and commonly *gustatorii*, arise each from the lateral part of the extremity of the medulla oblongata, between the oblong inferior eminences, by several filaments, which uniting together, form commonly two small ropes on each side, which pierce the dura mater separately, and presently afterwards form one rope, which goes out of the cranium through the anterior condyloide hole.

147. The tenth pair, called *nervi sub-occipitales*, arise under the ninth pair, chiefly from the anterior and a little from the lateral part of the extremity of the medulla oblongata, opposite to the posterior part of the condyloide apophysis of the occipital bone, by a single plane or fasciculus of small filaments which pierce the dura mater directly from within outward, at the same place where the vertebral arteries perforate it from without inwards.

148. The nerves formed by the lateral union of the anterior and posterior filaments of the medulla spinalis, go out of the bony canal of the spina dorsa, toward each side, through the intervertebral

*Nerves of the medulla spinalis.*

holes, through the anterior holes of the Os Sacrum, and the lateral notches of the Os Coccygis; and from thence they have the general name of *nervi vertebrales*. They are divided in the same manner as the vertebræ, into seven pair of cervical nerves, twelve pair of dorsal, five pair of lumbar, and five or six pair of *nervi sacri*.

149. I observed in the particular description of the nerves, that I begin the enumeration of the vertebral nerves by those which go out between the first and second vertebra; and that the situation of the dorsal or costal nerves which are true intercostals, determined me to this disposition, the first pair of these nerves passing between the first and second true ribs.

150. As the spinal marrow which furnishes all these nerves, seldom goes lower than the first or second vertebra of the loins, as I have already said, the situation of the fasciculi of nervous filaments must be different from that of the holes through which they pass; and several of these fasciculi, both anterior and posterior, must be longer than the rest. This we find from experience to be the case in the following manner.

151. The fasciculi of nervous filaments of the medulla spinalis, which produce the cervical nerves, run more or less transversely toward each side from their origin to their passage through the intervertebral holes. The fasciculi which form the dorsal nerves run a little obliquely downward from their origin to the intervertebral holes; and those which form the lumbar nerves run down more and more longitudinally from the medulla to the holes by which they go out.

152. Therefore the cervical fasciculi are very short in the spinal canal; the dorsal fasciculi are longer, and the fasciculi from the loins and Os Sacrum very long. It must likewise be observed that the fasciculi of the four lowest pairs of the cervical nerves, and first pair of the dorsal nerves, are broader and more compounded than the following, because the brachial nerves are a continuation of these. The filaments belonging to the lumbar nerves and those of the Os Sacrum, are likewise very broad, and made up of numerous filaments, as being the roots of the large nerves which go to the lower extremities. The dorsal filaments are very small.

153. The cervical and lumbar fasciculi are not only broader and made up of more filaments than the dorsal, but also situated

situated much closer to each other, the lumbar fasciculi being still more so than the cervical; whereas in the dorsal a considerable interstice is left between the fasciculi.

154. These lumbar fasciculi, from their origin to the extremity of the Os Sacrum, form, through the whole canal of the lumbar vertebræ and of the Os Sacrum, a large bundle of nervous ropes called by anatomists, *cauda equina*, because of some resemblance which it bears to a horse's tail, especially when taken out of the canal and extended in clear water.

155. Though the medulla spinalis ends at the first vertebra of the loins, the vagina of the dura mater by which it is invested, is continued through the rest of the bony canal all the way to the extremity of the Os Sacrum, and involves the great bundle or cauda equina, the cords of which pierce it on each side nearly opposite to the places where they pass through the intervertebral holes, and the anterior holes of the Os Sacrum, almost in the same manner as was said above, in describing the general formation of the vertebral nerves.

156. This vagina of the dura mater being separated from the canal of the vertebræ, and the lateral elongations which serve for particular vaginæ to the cords, being cut off, it presently shrinks up and contracts in the same manner as all the other elastic parts of the human body; for instance, as an artery does when cut transversely soon after death. Therefore its true length must be taken while it is in situ, and likewise the true situation of the lateral elongations.

157. From all this a conclusion may be drawn of great importance, not only in anatomical and philosophical inquiries, but also for understanding local diseases, wounds, &c. which is, that when we have occasion to consider any particular nerves near the vertebræ of the back or loins, or near the Os Sacrum, we must remember that in the spina dorsalis the origin of these nerves is not even with their passage out of the spine; but proportionably higher. If, for instance, we enquire about any of the lowest nervi sacri near the Os Coccygis, we must not stop at the extremity of the Os Sacrum, but trace its origin as high as the last vertebra of the back, or first of the loins.

158. The membrana arachnoides accompanies the original fasciculi separately, to their passage through the lateral elongations



tions of the dura mater, forming a kind of duplicature, breaks, or discontinuations between the cords which run in the vagina of the dura mater. The internal lamina of the pia mater, or the pia mater simply, as it is here reckoned, adheres very closely both to the fasciculi and filaments of which they are composed.

159. Among the original productions of the nerves of the medulla spinalis, we ought still to reckon the formation of the nervi accessorii of the eighth pair, or of those that I call *sympathetici medii*. They arise from the lateral parts of this medulla by several filaments, about the third or fourth vertebrae of the neck, and sometimes lower. And, if my memory does not fail me, I once traced them to the middle of the back. They run up on each side between the anterior and posterior ranks of the nervous fasciculi, increasing gradually in size by the accession of new filaments from the posterior fasciculi.

160. Having reached above the first vertebra of the neck, they have a kind of adhesion or communication with the neighbouring ganglions of the nervi sub-occipitales, or those of the tenth pair. Above this adhesion they receive two filaments each, from the backside of the medulla, and afterwards continue their course towards the great occipital foramen. As they enter the cranium, they communicate with the nerves of the ninth and tenth pairs; and at the foramen lacerum, they join those of the eighth pair, with which they return out of the cranium.

161. In the posterior part of the medulla spinalis, near its lower extremity, there is in some subjects a longitudinal depression, in which several transverse fibres are situated, which though I have not examined any further, I thought it proper to mention this observation, as I found it in my anatomical common-place book.

#### § 8. *Blood-vessels of the brain and medulla spinalis.*

162. The arteries which supply the cerebrum, cerebellum, and medulla oblongata, come partly from the *Arteries.* carotids which enter the cranium through the canals in the apophyses petrosæ of the Ossa Temporum, and partly from the vertebrales which enter by the great occipital

tal foramen, and send off the arteriæ spinales into the canal of the spine for the medulla lodged there.

163. All these arteries are divided into several branches which send out a great number of ramifications distributed through both substances of the brain, and through the whole extent of the pia mater. The dura mater both of the cerebrum and cerebellum has arteries peculiar to it, which have been already described.

164. The internal carotid on each side enters the cranium by the great canalis petrosus, in an angular or winding course, as was observed in the description of the skeleton. The inner surface of this canal is lined by a production common to the dura mater and inferior pericranium; to which the artery adheres only by a loose filamentary substance, in which the plexiform filaments run, that belong to the great sympathetic nerve commonly called *the intercostal*.

165. Having passed through the bony canal, it immediately bends upward toward a notch in the sphenoidal bone, and through that notch it enters the cranium. Immediately after this, it penetrates the cavernous sinus on the side of the sella sphenoidalis, where having formed a third curvature, it goes out from it, from below, upwards, and is bent a fourth time round the anterior clinoid apophysis, from before backward. By this course it is in a manner bathed in the blood of the cavernous sinus, together with the third, fourth, fifth, and sixth pairs of nerves.

166. After this fourth curvature the internal carotid having now reached the side of the infundibulum, and consequently being very near its fellow, these two arteries communicate sometimes by a very short transverse arterial production. At this place each of them divides into two principal branches, one anterior, the other posterior; and sometimes into three, in which case there is a middle branch between the two former.

167. The anterior branch runs, first of all, forward under the basis of the cerebrum, separating a little from the same branch of the other carotid. They approach each other again under the interstice between the two olfactory nerves, communicating by a very short anastomosis, and sending small twigs to that pair of nerves. They afterwards separate, being each divided into two or three rami.

168. The

168. The first ramus of the anterior branch goes to the anterior lobe of the cerebrum. The second, which is sometimes double, is inverted on the corpus callosum, to which it gives ramifications, as also to the falx of the dura mater and middle lobe of the cerebrum. The third, which is sometimes a distinct branch, sometimes only an additional ramus to the second, goes to the posterior lobe of the cerebrum. This third ramus is sometimes so considerable as to deserve to be reckoned the middle branch of the three principal ones.

169. The posterior branch communicates first of all with the vertebral artery of the same side, and then is divided into several rami on the superficial circumvolutions of the cerebrum, and between these circumvolutions all the way to their bottom. The anterior and middle branches, when there are three, distribute the same kind of ramifications to the circumvolutions, and to their interstices.

170. All these different ramifications run on the duplicature of the pia mater, from which they receive a kind of additional coats, and the capillaries being distributed upon it in a reticular manner, do afterwards penetrate the cortical and medullary substance, in which last they terminate insensibly.

171. The vertebral arteries enter through the great occipital foramen, having first pierced on each side the elongations of the dura mater at the same place where the sub-occipital nerves, or those of the tenth pair pierce it, as they go out; the arteries in this place lying above the nerves.

172. At their entry into the cranium they send each several ramifications to the cauda of the medulla oblongata, and to the corpora olivaria and pyramidalia, which ramifications are distributed on the sides of the fourth ventricle, produce the plexus choroides, are spread on the whole surface of the cerebellum, insinuate themselves between the strata, always invested by the duplicature of the pia mater, and are at length lost in both substances of the cerebellum.

173. Afterwards the two vertebral arteries turn toward each other, for the most part immediately under the posterior edge of the great transverse or semi-annular protuberance of the medulla oblongata, where they unite and form one common trunk. This trunk passes directly from behind forward,



forward, under the middle of the great protuberance, and partly in the middle groove of the convex surface of that protuberance, at the anterior edge of which it terminates.

174. In its passage through the groove, this trunk sends off several small branches on each side, which surrounds transversely the lateral portions of the protuberance, being partly lodged in the small lateral grooves of these portions. These lateral branches are afterwards distributed to the neighbouring parts of the cerebrum, cerebellum, and medulla oblongata.

175. This common or middle trunk of the vertebral arteries having reached the edge of the great protuberance, is divided again into small branches, each of which soon communicates with the trunk of the internal carotid on the same side. Instead of this bifurcation, the two last or most anterior lateral branches, send each sometimes a small branch forward, which form the anastomoses with the internal carotids.

176. The principal arteries of the medulla spinalis, called commonly *arteriæ spinales*, are two in number, one anterior and one posterior, lodged in the grooves by which the medulla is divided into lateral portions on both sides. They arise from the vertebral arteries, a little above the great occipital foramen, where these arteries send each a small ramus downward, as soon as they enter the cranium; and having got under the extremity of the medulla oblongata, they send off two other branches backward.

177. The first two branches uniting soon after their origin, form the *arteria spinalis anterior*, which runs down within the canal of the vertebræ along the anterior groove of the medulla. The other two small branches are inverted on the sides of the medulla oblongata, and from thence running backward, they unite much in the same manner with the first two, and form the *arteria spinalis posterior*, which runs down along the posterior groove of the medulla spinalis.

178. The two spinal arteries in their course downward along the medulla, send off on each side lateral ramifications, by which they frequently communicate with each other; and likewise with the vertebral arteries of the neck, with the intercostals, and sometimes they are in a manner split for a little way, and then unite again.

179. The veins of the cerebrum and cerebellum, &c.

may in general be looked upon as branches not only of the longitudinal sinus of the dura mater, and of the two great lateral sinuses, but also of all the inferior sinuses of that membrane; in all which sinuses the veins terminate by different trunks in the manner already said in the description of the great superior sinus. Their principal ramifications accompany all the cortical circumvolutions of the cerebrum, and directions of the strata of the cerebellum, running always in the duplicature of the pia mater. The veins of the plexus choroides in general are of the number of these already mentioned.

180. The veins of the medulla spinalis are branches partly of the superior extremities of the two vertebral veins, partly of the two venal ropes termed *sinus venosi*, which run down both ways laterally on the anterior convex side of the production of the dura mater, and form at different distances reciprocal communications, by semi-annular arches, as by so many subordinate sinuses. The two longitudinal sinuses communicate likewise in their passage with the vertebral veins, in the same manner as the neighbouring arteries.

§ 9. *Uses of the brain, and of its appendages in general.*

181. We are obliged to the great Malpighi for the first and best instructions concerning the manner of examining the structure of the brain, especially that of the two substances of which it is made up, and for putting us in a condition to be able to conjecture something about its uses. The experiments and observations of that illustrious and faithful searcher into nature, having been repeated by several excellent philosophers, and confirmed by comparative anatomy, leave us no room to doubt but that the brain is a secretory organ, or, as it is called by anatomists, *a gland*.

182. It is to no purpose to dispute about words, when we are agreed as to things themselves. Anatomists have for many years past understood by the word *gland*, an organ fitted to separate some particular fluid from the mass of blood, as universally as they mean by the word *muscle*, all sorts of fleshy fibres capable of contraction; and this last term might be cavilled at and rejected as justly as the other.

183. The whole matter of secretions must be owned to be very obscure; but it is to be hoped that the brain and liver  
will

will some time or other lead us so far from the knowledge of it, as at least to be able to distinguish truth from falsehood.

184. The greyish or ash colour of the cortical substance is not the effect of a particular mixture of red and white; at least we have no experiment to prove it. The blood indeed gives this substance a slight reddish cast; but the ash colour which seems to be the characteristic of the structure of these secretory organs, is not owing to that.

185. We learn from M. Ruysch's anatomical injections, that the cortical substance is chiefly composed of vessels; that by making these vessels swim in a clear pellucid liquor, their extremities represent an infinite number of fine brushes or vascular tufts, and that his injection fills even the smallest filaments of these tufts. He tells us likewise, that in these last filaments the structure is altered; and that, by the mechanism of this change, the functions attributed to glands may be performed.

186. But still these injections and preparations do not unravel the mystery; neither is the existence of these pencils or tufts sufficiently demonstrated; for they are only the last extremities of the small arteries macerated in water, or some other liquor, after being injected; and then artfully separated from the other essential parts of the organ.

187. In the first place, they are separated from the venal extremities which must answer to these tufts, in what manner soever that be brought about. Secondly, they are separated from the membranous filaments of the pia mater, which in the natural state tie these arterial extremities to each other, and give them a different disposition from that of tufts or pencils. Thirdly, by this separation the arterial extremities are separated from their connections with the medullary substance; which both experiments and comparative anatomy shew to be fibrous.

188. It is nowise surprising that these capillary extremities thus stript should float loosely and freely when moved in a fluid, and that they should put on the appearance of pencils or tufts, being in this state only the truncated extremities of small vessels. When we consider these circumstances attentively, we find ourselves obliged to return to the small glandular bodies and folliculi, &c. of Malpighi, of which in another place; and at the same time we must acknowledge that



Ruyfch's fine injections have discovered these minute bodies to be of a vascular substance, the structure of which we are still ignorant of.

189. In a word, Malpighi has discovered the glandular tubercles and folliculi without destroying their natural connections. Ruyfch has discovered a considerable part of their structure by destroying their connections. We are therefore very much beholden to both these illustrious anatomists, and it is only by joining their observations to each other, that we can ever be able to form an idea of the secretory organs, which will answer all the phænomena concerning the different secretions in the human body.

190. The infinite number of these small secretory clusters, strain or filter the mass of blood carried to them by the numerous ramifications already mentioned, and separate from it, an excessively fine fluid; the remaining blood being conveyed back by the same number of venal extremities, into the sinuses of the dura mater, and from thence into the jugular and vertebral veins.

191. This subtle fluid, called commonly *animal spirit*, *nervous juice*, or *liquor of the nerves*, is continually forced into the medullary fibres of the white portion of the cerebrum, cerebellum, medulla oblongata, and medulla spinalis; and by the intervention of these fibres supplies and filis the nerves, which are a continuation of them.

192. All the nervous ropes, as they pass through the foramina of the cranium and vertebræ, are accompanied by particular elongations of the pia and dura mater. Those of the dura mater serve them for vaginæ in their passage through the bony openings. Those of the pia mater not only accompany and invest each nervous rope, but also form internal septa between all the filaments of which each rope consists. It is known from many experiments, that the nerves are the primitive or original organs of all muscular motion and of all animal sensation; and that these two functions depend in general on the brain; but we are ignorant of the nature of this dependance, and of the particular uses of the medullary fibres of the nervous fluid, and of the membranous productions which accompany the fibres and nerves.

193. Neither is there any thing certain in what has been said concerning the design or particular uses of the superficial

conformation of the cerebrum and cerebellum, or of the different configuration of their turnings, circumvolutions, eminences, depressions, expansions, and various folds. It may be affirmed in general, that by this structure the extent of the secretory organ of the nervous fluid is increased very considerably, and the particular functions of each nervous rope distinguished, and likewise their general and reciprocal correspondence, both in regard to the exquisiteness of the organs of sensation, and the activity of the organs of motion.

194. The falx of the dura mater hinders one portion of the cerebrum from pressing on the other, when we lie on one side. The transverse septum serves for a tent to the cerebellum, and defends it from a mortal compression which it must otherwise be liable to from the cerebrum, especially when we walk or jump.

195. The septum and productions of the pia mater connect and strengthen all the circumvolutions, divisions and ridges of the cerebrum, cerebellum, &c. and sustain in a general and almost incomprehensible manner all the branches and ramifications of the blood vessels, all the medullary filaments, and all the elongations and ropes that depend on these.

§ 10. *A Dissertation on the anatomy of the Brain by M. Steno, read in the assembly held at M. Thevenot's house in the year 1668.*

GENTLEMEN,

Instead of promising that I shall satisfy your curiosity in what relates to the anatomy of the brain, I begin by publicly and frankly owning that I know nothing of the matter. I wish I were the only person under a necessity of talking in this manner, because I might in time become acquainted with what others know; and it would be a great blessing to mankind, if this most delicate part, and which is liable to so many dangerous diseases, were as well understood as the generality of anatomists and philosophers imagine it to be. In this, few imitate the sincerity of Silvius, who never talks positively concerning the brain, though he has been at more pains about it, than any man that I know. The number of those

those who think every thing easy, is infinitely the greatest; and they give us the history of the brain and disposition of its parts with the same confidence and assurance, as if they had been present at the formation of this surprising machine, and had been let into all the designs of the great architect. Though the number of these positive gentlemen may be very great, and though I cannot pretend to answer for the sentiments of all the rest, I am nevertheless very much convinced, that they who search for solid knowledge, will find nothing satisfactory in all that has been written about the brain. It is very certain that it is the principal organ of the soul, and the instrument by which it works very wonderful effects. The soul which imagines it can penetrate into every thing without it, and that nothing in the world can set bounds to its knowledge, is nevertheless utterly at a loss to describe its own habitation, and is no where more to seek than at home. We need only view a dissection of that large mass, the brain, to have ground to bewail our ignorance. On the very surface you see varieties which deserve your admiration; but when you would look into its inner substance, you are utterly in the dark, being able to say nothing more than that there are two substances, one greyish, the other white, which last is continuous with the nerves distributed all over the body; that the greyish substance serves in some places for a cortex to the white, and that in other places it separates the white filaments from each other.

If we are asked what these substances are, in what manner the nerves are joined in the white substance, or how far their extremities penetrate into it; all we can do is to own our ignorance, except we be resolved to increase the number of those who prefer the applause of the public to sincerity and truth. For, to say that the white substance is only an uniform body like wax, without any art concealed in it, would be to think too meanly of this great master-piece of nature. We are sure that where-ever there are fibres in the body, they always observe a certain regular order more or less complex in proportion to the functions for which they are appointed. If this substance is every where fibrous, as it appears in many places to be, you must own that these fibres are disposed in the most artful manner; since all the diversity of our sensations and motions depends upon them. We admire



admire the contrivance of the fibres of every muscle, and ought still more to admire their disposition in the brain, where an infinite number of them contained in a very small space, do each execute their particular offices without confusion or disorder.

The ventricles or cavities of the brain are no less unknown than its substance. They who place the animal spirits there, think they are as much in the right as they who make them receptacles of the excrements; but they are both equally puzzled, when they are desired to explain the origin of these spirits and excrements. They may come from the vessels found in these cavities as well as from the substance of the brain; and it is equally difficult to determine how they get out.

Among those who place the animal spirits in the ventricles, some make them pass from the anterior to the posterior ventricles, there to meet with the entries of the nerves, while others affirm that these entries are in the anterior ventricles. Some imagine that the excrements of the brain are contained in the ventricles, because they think they see something like excrements there; but they own that there is a ready passage for them from the brain down to the medulla, as into the infundibulum; and supposing they go into the infundibulum, they may be carried from thence into the sinuses of the dura mater, and there is some reason to believe that they may have an immediate passage into the eyes, nares, and mouth.

We are still more uncertain about what relates to the animal spirits. Are they blood, or a particular substance separated from the chyle by the glands of the mesentery? or may they not be derived from a lymphatic serum? Some compare them to spirit of wine, and it may be doubted whether they are not the matter of light. Our common dissections cannot clear up any of these difficulties.

The true manner of dissecting the brain is as little known as its substance. I need not mention the method of cutting it into slices, because it is owned by every body that nothing can be learned that way. The second method of unfolding all the plicæ is something more artful; but it only shows us the outer surface of what we want to know, and even that very imperfectly.

The third method of unfolding the plicæ, and separating the

the two substances goes no further than the surface of the medulla. These three methods have been differently combined; and they may be still more diversified according as they are executed longitudinally, tranversely, &c.

As for my own part, it is my opinion that the true method of dissection would be to trace the nervous filaments through the substance of the brain, to see which way they pass, and where they end; but this method is accompanied with so many difficulties, that I know not whether we may hope ever to see it executed without a particular manner of preparing. The substance of the brain is so soft, and the fibres so tender, that they can hardly be touched without breaking. Since therefore anatomy has not hitherto arrived to that degree of perfection as to make the true dissection of the brain, let us, without flattering ourselves any longer, freely acknowledge our ignorance, that we may not first deceive ourselves, and others afterwards, by promising to shew them the true structure of this organ.

I should tire your patience instead of entertaining you, were I to mention particularly all the disputes that have arisen about the brain: books are but too full of them; and therefore I shall only relate the principal mistakes that still subsist among anatomists, and which may be corrected by anatomy; and they may be reduced to these heads. Some pretend to shew parts in the brain as separate, which are only a continuation of the same substance; and others would persuade us that the parts touch each other without any connection, though they are visibly joined together by filaments or vessels. Some situate the parts in the manner which is most agreeable to the systems they have framed, without considering that they are quite otherwise situated by nature. They shew you the pia mater, for instance, in places where it never was; and do not see the dura mater in places where it is very visible; and in case of need, they will make the very substance of the brain pass for a membrane.

I have too good an opinion of men of learning in general, to believe that they do this with a design to deceive others; but the principles which they have established, and the method of dissection to which they have accustomed themselves, oblige them to it. All anatomists would demonstrate the parts the same way, if they made use of the same method; and

and therefore we ought not to be surpris'd if their systems are very ill founded.

The ancients were so far prepossessed about the ventricles as to take the anterior for the seat of common sense, the posterior for the seat of memory; that the judgment which they said was lodged in the middle, might more easily reflect on the ideas which came from either ventricles. I would only ask those who are still of the same opinion, to give us the reason why we should believe them, for there is nothing satisfactory in all that has been hitherto said in favour of it; and as that fine arched cavity of the third ventricle where they placed the throne of judgment does not so much as exist, we may easily see what judgment is to be pronounced on the rest of this system.

Willis is the author of a very singular hypothesis. He lodges common sense in the corpora striata, the imagination in the corpus callosum, and the memory in the cortical substance: but without being at pains to enter into the detail of his whole hypothesis, we need only make the following remarks upon it. He describes the corpus striatum, as having two sorts of striæ, one ascending, the other descending; and yet if you separate the cortical from the white substance, you will perceive that these striæ are all of the same nature, that is, that they are part of the substance of the corpus callosum which runs toward the medulla spinalis, parted into different lamellæ by the intervention of the ash-coloured substance.

How can he then be sure that these three operations are performed in the three bodies which he pitches upon? Who is able to tell us whether the nervous fibres begin in the corpora striata, or if they pass through the corpus callosum all the way to the cortical substance? We know so little of the true structure of the corpus callosum, that a man of tolerable genius may say about it whatever he pleases.

M. Descartes knew too well how imperfect an history we have of the human body to attempt an exposition of its true structure; and accordingly in his *Tractatus de homine*, his design is only to explain a machine capable of performing all the functions done by man. Some of his friends have indeed expressed themselves on this subject differently from him; but it is evident from the beginning of that work, that



he intended no more than what I have said ; and in this sense, it may justly be said that M. Descartes has gone beyond all the other philosophers. He is the only person who has explained mechanically all the human actions, and especially those of the brain. The other philosophers describe to us the human body itself. M. Descartes speaks only of a machine, but in such a manner, as to convince us of the insufficiency of all that has been said before him, and to teach us a method of enquiring into the uses of the parts with the same evidence with which he demonstrates the parts of his machine called *a man*, which none had done before him.

We must not therefore condemn M. Descartes, though his system of the brain should not be found altogether agreeable to experience ; his excellent genius, which shines no where more than in his *tractatus de homine*, casts a veil over the mistakes of his hypotheses, especially since even Vesalius himself and other anatomists of the first rank, are not altogether free from such mistakes. And since we can forgive these great men their errors, who passed the greatest part of their lives in dissecting, why should not Descartes meet with the same indulgence, who has happily employed his time in other speculations ?

The respect which I and all the world owe to such superior geniuses, would have inclined me to continue only to admire this treatise as containing the description of a fine machine invented by the author, if I had not met with several persons who would make us believe that it is a faithful relation of the most secret springs of the real human body. Since these persons are not convinced by Silvius's repeated demonstrations, that M. Descartes's descriptions do not agree with what appears in dissecting the human body, I find myself obliged to point out some parts of his system, without relating the whole, in which they must see, if they have a mind to be instructed, the vast difference there is between Descartes's imaginary machine, and the real machine of the human body.

The glandula pinealis has lately been the subject of the greatest disputes touching the anatomy of the brain ; but before I enter upon that matter, or endeavour to determine the place where it lies, I must first give Descartes's own opinion in his own words, contained in the following passages, to which I have added several others taken from the same treatise, at the end of this discourse.

“ The

“ The surface of the glandula pinealis has a relation to the inner surface of the brain.

“ In the concavity of the brain, the pores are directly opposite to those of the small gland.

“ The spirits run from all sides of the gland into the concavities of the brain.

“ The gland may perform its functions, though it be inclined sometimes to one side, sometimes to the other.

“ The small tubes on the surface of the concavities are always turned to the gland, and may easily be turned toward the different points of this gland.”

From all these passages, it is certain that he believed the glandula pinealis to lie entirely in the cavities of the brain. And though, in some other places, he says, that it is situated at the entry of these cavities, yet we are not to think that this is contrary to what he advances in the passages here quoted; for as it is but a very small body, it may lie either at the entry, or in any other place of the cavities, and yet still be within them, which he declares to be his opinion in many other places.

We are now to examine whether this opinion be not contrary to experience. It is very certain that the basis of this gland reaches immediately from the passage of the third ventricle to the fourth; but the posterior part, that is, one half of the gland, may evidently be perceived to be altogether without the cavities, by only removing the cerebellum, and one or both of the tubercles of the third pair, with dexterity and care; upon which the posterior part of the gland will be brought into view, and yet no passage will appear, by which the air or any other fluid can pass into the ventricles.

To prove that the anterior part of the gland is not in the lateral cavities, we need only look upon them, after they have been opened either in Silvius's way, or in that of the ancients; for the substance of the brain will always be found to lie between these lateral cavities and the gland. The same thing may be demonstrated without cutting the substance of the brain, by separating from its basis the part which contains these cavities; for the gland will then appear to be so far out of the cavities, that it can have no manner of relation to them, being hindered by the insertions by which this part is fixed to the basis. The ancients knew very well that the fornix is

not continuous with the basis of the brain, but that it forms a third cavity on its under side, and by forcing in air through the fissure between the tubercles of the second pair, we raise the fornix, and thus by breaking the filaments which connect it to the basis, a large cavity is formed; from whence some have imagined that when the spirits swell the cavities, the fornix rises, and that all sides of the surface of the gland are turned toward the cavities.

I say some have imagined this, because though the fornix be raised in the manner already said, only the anterior surface of the gland can be turned towards the lateral cavities; but no preparation whatever can turn the posterior surface toward the posterior ventricles. But if the brain has suffered no violence, either in opening the cranium, forcing in air, or by any other method, the cavity of this third ventricle will be found very narrow at the middle, and to contain nothing but the great vein which forms the fourth sinus, and the glandular bodies, which accompany this vein.

I own that behind this fissure, and immediately below its posterior opening, there is a cavity lined on the fore and lateral parts by that part of the plexus choroides which runs up toward the fourth sinus, and at the back-part, closed by the glandula pinealis, the anterior portion of which is perfectly continuous; and when the fornix is removed, this cavity remains entire under the first, in the shape of a kind of inverted horn.

What Descartes says, that the glandula pinealis may perform its functions, though it inclines sometimes to one side, sometimes to another, experience shews to be groundless; because it is so hedged in between all the parts of the brain, and so fixed to them on all sides, that it cannot be moved in the least without violence, and without breaking the fibres by which it is connected. It is easy to shew likewise that M. Descartes has not represented it in its true situation, which is neither perpendicular, as he represents it, nor inclined forward, as other very great anatomists believe; but its point is always turned toward the cerebellum, and makes nearly half a right angle with the basis.

The supposed connection of this gland with the brain by means of arteries, is likewise groundless; for the whole basis of the gland adheres to the brain, or rather the substance of the

the



the gland is continuous with that of the brain, though the contrary be affirmed by Descartes.

The hypothesis of arteries meeting round the gland, and from thence running up to the great euripus, as it is called, is of great moment in Descartes's system, because the separation and motion of the spirits depend upon it. But if we can believe our eyes, this is no more than a collection of veins from the corpus callosum, from the anterior substance of the brain, from the plexus choroides, from different places of the basis of the brain, and from the gland itself; the office of which veins is to carry back the blood from the brain to the heart, and not to bring it from the heart to the brain. Some have thought that M. Descartes designed to carry the nerves to the gland, but he never had any such intention.

Such of M. Descartes's friends who look upon his man only as a machine, will be so good as to believe that I do not here speak against his machine, the contrivance of which I have always admired; but as for those who pretend to demonstrate that M. Descartes's man is made like other men, anatomical observations may easily convince them that this is a fruitless attempt. And if they should plead the same experience on their side, we may readily answer, that there is nothing more common than not to perceive the mistakes we commit in dissecting the brain, as will evidently appear in the sequel of this dissertation.

I designed to have mentioned the other systems of the brain by which the animal actions have been accounted for; and the origin and composition of the fluids contained in the brain, been explained; but I considered afterwards, that this undertaking requires more application and leisure than my journey will allow me.

Dissections or preparations being liable to so many mistakes, and anatomists having hitherto too readily formed systems, and moulded these soft parts in the manner that was most agreeable to each, we cannot be surprised to find so little exactness in their figures. But this want of accuracy in the figures is not owing to bad dissections only. The ignorance of drawers has contributed very much, and the difficulty of expressing the several eminences and depressions of the parts, and of understanding what the anatomists chiefly insist upon, furnishes them with a never-failing excuse. The best figures  
of

of the brain are those of Willis, but even these contain a great number of important mistakes, and they want many things to perfect them. In the third figure he represents the superior or pineal gland like a round ball; and consequently, according to this figure, the apex of that gland cannot be said to be turned either forward or backward. Besides, we see here nothing of the substance of the brain on the fore-side of the gland, and which goes from one side to the other; all which the figure would make us believe to be annihilated. Behind the gland, a space appears on the basis of the brain between the two tubercles of the third pair, which, in the natural state, has a quite different appearance. The thin expansion of the white substance of the cerebrum, which is continued to the middle of the cerebellum, where it is very thick, is quite wanting; as also the origin of the *nervi pathetici*, which go out from this expansion. He likewise represents the second pair of tubercles as distinct, which commonly adhere to each other. The under side of the fornix appears to be uniform, which is of an uneven and very elegant structure. When we cut the corpus striatum transversely, we see radii very different from what they are exhibited in Willis's eighth figure. The white radii appear there to be continuous with the fore-part of the corpus striatum, which nevertheless is of an ash-coloured substance, and as it runs in between the white radii, does not appear, in that method of dissecting, to adhere to any other body whatever.

In the third figure the infundibulum has no resemblance to nature. The *nervi motores oculorum* are straight and not oblique as they ought to be; neither do we see the true origin of the filaments of which these nerves are composed, from the basis of the brain. The pons Varolii might have been better and more distinctly expressed; and the anterior roots of the fornix are not separated as in the seventh and eighth figures, but touch each other at the upper part, and form an acute angle. The line marked G. G. G. in the seventh figure appears to be a continued line, though the part between the roots of the fornix which is represented, has no connection with the extremities; and in the same figure the glandula pinealis is connected to the substance of the brain by two funiculi. I need say nothing of the figures of Vesalius, Casserius, &c. for since these which are the latest and best, are so very imperfect,

imperfect, we may easily imagine how little regard is to be paid to the others.

I have seen but three figures of Varolius which express in a wretched manner the best observations that have ever been published on the brain. I do not know whether the figures of the first edition at Padua in 1573, may not be better than those which I have seen published at Frankfort in 1591, and again in Bauhinus's anatomy. Among Bartholinus's figures, there are three which represent the brain dissected after Silvius's method; but the author himself owns that they are faulty. But to pass over many other mistakes in all these figures, there is not one amongst them which represents truly the situation of the glandula pinealis; the duct of the third ventricle; the plexus choroides; the ramifications of the veins contained in the lateral cavities; the distribution of the arteries; the concurrence of the veins which forms the fourth sinus; or the numerous glandular bodies lodged there.

From all this you see how the brain has been hitherto dissected, how little knowledge has been gained from these methods of dissection, and how falsely the figures represent the parts which they are designed for. It is easy to conclude from hence how little regard is to be paid to the systems built on these bad foundations, in framing of which the authors, by an unaccountable sort of misfortune common to this with all other arts, have employed obscure terms, metaphors and comparisons, all of them so ill chosen, as to be equally puzzling to those who have made some progress in this science, and those who begin to learn it. Besides, the greatest number of these terms are so low and so unworthy of the most noble part of the body of man, that I am at a loss whether I ought most to wonder at the bad turn of thought of those who first made use of them, or at the indolence of their successors, who continue still to retain them. What necessity could there be to employ the words *nates*, *testes*, *anus*, *vulva*, and *penis*, which in their common signification have no relation at all to the parts expressed by them in the anatomy of the brain? And accordingly what one author calls *nates*, another calls *testes*, &c.

The *third ventricle* is a very equivocal term. The ancients understood by this word, a cavity under the fornix which they believed to be separated from the basis of the brain, and they



they have represented it with three legs, that it might support the brain which lies upon it. M. Silvius calls the third ventricle a *canal* found in the substance of the basis of the brain, between the infundibulum and the passage which goes under the two posterior pairs of the tubercles of the brain, towards the fourth ventricle. Some anatomists having separated the bodies of this second pair of tubercles, take the space between them, which is owing to their manner of dissection, for the third ventricle, which is consequently sometimes the fissure above and sometimes the canal below; and some will have it to be the space between the fissure and canal, which is likewise owing to the rupture of the parts already mentioned. We have therefore three third ventricles, the second of which alone is the true one; the first and third arising entirely from the methods of preparing the parts. To these a fourth third ventricle might be added, if the small fissure under the fornix could be looked upon as a passage between the two anterior ventricles and the fourth. But it is so small and so full of the vessels and glands of the plexus choroides, that I doubt very much whether there can be any communication that way, between the anterior and posterior ventricles, especially since Silvius's third ventricle is sufficient for that purpose, and likewise answers the design so perfectly well, that whatever goes from the lateral to the posterior ventricle, must first of all fill the infundibulum and this canal.

Two glands are reckoned to belong to the brain, though we know not if either of them resembles glands in any thing more than in the figure, and even that, when well examined, will be found to be different from what it is in the rest. The superior or pineal gland is not like a pine apple, either in brutes or in man; and it is not known whether the inferior or pituitary gland acts in any respect on the pituita.

The plexus choroides represents a vascular texture, in which the veins are seen very distinct from the arteries, and the distribution of each may be traced separately. The name of fornix gives the idea of an arched or vaulted part, which however is not to be found, when looked for in a proper manner. The corpus callosum in the common signification means the white substance of the brain which comes into view when the two lateral parts are separated; but as it entirely resembles the

the rest of the substance of the brain, there can be no reason for giving a particular name to one part of this substance.

There are but two ways of coming at the knowledge of a machine; either to be taught the whole contrivance by the maker, or to take it quite to pieces, and to examine each by itself, and as it stands in relation to the rest. These are the only true ways of learning the contrivance of any machine, but the generality of inquirers have thought that they had better guess at it, than be at pains to examine it thoroughly. They have satisfied themselves with observing its motions, and on these observations they have built systems which they believed to be true, because, by their help, they imagined they could explain all the effects which they knew. They never considered that the same thing may be explained in different manners; and that the senses alone are capable of informing us whether our ideas be conformable to nature. As the brain is a machine, we must not flatter ourselves that we can discover the contrivance of it by any other means than are made use of for knowing other machines; and we have no way left but to take it to pieces, and to consider what every part is capable of in a separated and in an united state. In this search, we may truly say that few anatomists have discovered any great degree of curiosity. Chymistry has in all ages found both private men and princes very ready to erect laboratories; but few have pursued anatomy with equal ardour. This neglect is not owing to princes, among whom many have had curiosity enough for such an important part of knowledge, to build magnificent anatomical theatres, which they have often honoured with their presence. But the dissectors being always willing to appear complete masters of this science, never have had the sincerity to own that any thing still remained to be known, and to conceal their ignorance, have contented themselves with demonstrating what is to be found in the writings of the ancients.

Anatomists might have reason to blame me, if I did not shew by a farther explanation that they are not so much in the wrong as I seem to insinuate, by saying, that they do not apply themselves sufficiently to anatomical enquiries. They that study anatomy are generally either physicians or surgeons, who being both obliged to visit their patients, have too little time left for study, after they have attained to a tolerable de-

gree of reputation. But they ought not to undertake the cure of a body, the make of which they do not know, that is, they ought not to endeavour to rectify a machine till they are previously acquainted with its nature. Others who do not visit sick persons, and have no other business than that of teaching anatomy in public schools, do not look upon themselves as more obliged to pursue anatomical inquiries than the practising physicians and surgeons. The design of their profession is to teach to those who are to practise physic and surgery, the descriptions left us by the ancients, of the structure of the human body; and when they have clearly demonstrated all that is contained in the works of the ancients, and their hearers have as distinctly understood them, they both imagine that they have done their duty. The bounds of these different professions of teaching and practising have been so very ill settled, that the true knowledge of the human machine, though the most necessary branch, is neglected, as belonging neither to the anatomist, physician, nor surgeon.

To make the necessary enquiries for the discovery of truth, a man's whole time must be taken up; and professors of anatomy, who are obliged to make public demonstrations, which employ a great deal of time and labour, cannot be proper for this study, for the reasons already given, and for the following, which are no less evident.

1. There is so much time and application required to examine each part as it ought, that every thing else must be laid aside, and we must mind nothing but that. Physicians and surgeons cannot comply with this, because of their practice; nor professors, because of their public demonstrations. Whole years may sometimes be necessary to discover what may afterwards be demonstrated to others in the space of an hour. I do not question but that Pecquet was a great while in carrying the chyle from the mesentery to the subclavian vein; and perhaps I should not be believed, were I to mention what difficulties I found before I could shew the true insertion of Pecquet's duct, of which Bilsius had given us a figure; whereas at present they may be both prepared and demonstrated in half an hour.

2. Though anatomists open a thousand bodies in the schools, it is by mere accident if ever they discover any thing



thing new. They are obliged to demonstrate the parts as described by the ancients, and in doing this it is necessary they should follow a certain method; whereas inquiries admit of no settled method, but must be pursued in every manner that can be thought of. In the schools every thing must be removed that lies in the way of the part which they want to shew; but in particular searches no part must be cut off till we have first examined it; and if any such thing were attempted in public dissections, the demonstrator would be looked upon as ignorant; and the spectators would be often in the right to complain of loss of time, because he would not always be sure to find what he proposed to shew them. It is evident from these considerations, that professors have not hitherto been obliged to make inquiries in anatomy, and even that it is impossible for them to do it, were they ever so willing; so that it is not their fault that greater progress has not been made in that science.

Anatomy in general has, we see, been managed hitherto with very little success; and the inquiries into the brain have succeeded less than any others, because they have not been made with that care and diligence which the difficulty of the subject requires. Let us now consider the true method, and examine if any person has hitherto found it out.

Bilsius applied himself to anatomy, without having studied the writings of the ancients, and I make no question but that he would have made a greater progress, if, after having learned all that is good in these writings, he had employed his time and application in making new discoveries. We must own that the works of our predecessors contain very fine experiments, which we might still have been ignorant of, if they had not handed them down. And they have sometimes told us truths, which their successors, for want of sufficient application, have not been able to see. It must, however, be owned, that all that both ancients and moderns have told us about the brain is so uncertain, that the books which contain the anatomy of this organ may be said to be chiefly a collection of doubts, disputes, and controversies; but still a great advantage may be made of their labour, and even of their mistakes. I here speak of the authors who have dissected; for as for those who only copy the works of others, the best that can be said of them is, that it may

sometimes be proper to read their books by way of diversion. But they would have deserved a great deal more commendation, and been more useful to those who dissect, if they had given us only an exact relation of all that anatomists have wrote about the brain; if they had explained, according to the laws of a true analysis, all the different ways of accounting for the animal actions mechanically; or if they had made an exact list of all the propositions found in these writings, distinguishing those which are founded on facts and experience, from those which contain reasonings and conclusions drawn from the former. None of these methods have hitherto been pursued by the compilers, and therefore we must confine ourselves mostly to the original authors.

The first thing to be considered is the history of the parts; and in this we ought precisely to determine what is true and certain, that we may be able to distinguish that, from what is false or uncertain. Neither is it sufficient that we ourselves are satisfied about any thing; the evidence of our demonstrations ought to be so clear as to oblige every body else to assent to them, for otherwise the number of disputes would rather increase than diminish. Every anatomist who dissects the brain demonstrates from experience what he advances. This soft and pliable substance so readily yields to every motion of his hand, that the parts are imperceptibly formed in the same manner as he had conceived them before dissection; while the spectator who often sees two contrary experiments made on the same part, is either puzzled very much to know which he ought to embrace, or obliged to reject both to make himself easy. Therefore to prevent this inconvenience, it is absolutely necessary to carry dissections the length of a convincing certainty, which, though very difficult, is very far from being impossible. For I would not have you imagine from what I have said, that I believe there is nothing certain in anatomy; or that all who follow that study, make the parts appear as they have a mind, without any danger of being discovered. You may indeed justly doubt, if parts which are shewn you separated, were ever united; but it would be impossible to shew them united together, if they were not naturally so. To clear up any doubt that might arise on this subject; and to be certain whether the parts which are shewn you were naturally joined or not, you need

need only examine them in their natural state, without using any kind of violence, but allow those whom you have a mind to convince, to do all that is in their power to shew that they are united. We may come at the same degree of certainty in other circumstances, and particularly when we inquire into the situation of parts, provided we touch nothing without having first examined it, and set down every moment what we touch. In order to this, we must not only be very attentive to the part which we examine, but also reflect on all that we did before we reached it, to see if these operations may have changed it from its natural state in any respect. For by often handling more exterior parts, we may easily affect those that lie within them; and when these come in sight, we are apt to imagine that they are naturally such as they then appear, without considering how far we may have altered their situation and connection with other parts. The most famous anatomical dispute which this age has produced, may serve for an example of what I say. They who deny the continuation of the glandula pinealis with the substance of the brain, and the adhesion of the fornix to the basis of the brain, would not talk so positively concerning a matter of fact, if they did not believe it to be proved by incontestable experiments and observations. But in making these experiments they must necessarily have forgot the changes which happen in separating the exterior parts, and that they destroy all the connections by which the dura mater adheres to the cranium; and I have often observed, that, in raising the superior part of the cranium, the middle of the dura mater continued still to adhere to it, even after I had opened it sufficiently, to thrust in three fingers between the separated parts of the cranium. Now, how can the dura mater be thus raised without making the interior parts to which it is fixed suffer violence? The glandula pinealis adheres to the fourth sinus, which is connected with the falx, so that the dura mater cannot be raised at that place without affecting the gland. This falx receives likewise all the veins which pass between the fornix and the basis of the brain, and by which these two parts are connected. There is a pretty strong connection between the upper part of the brain and the dura mater; and when that membrane is raised, the brain must follow it, and the fourth sinus being carried upward breaks the connection between the fornix and the basis.

I have



I have many times been deceived about this when I first began to dissect the brain, and I used to wonder why these connections were not always sensible. But observing afterwards in horses, sheep, cats, &c. where that part of the dura mater which separates the cerebrum from the cerebellum is ossified, that I destroyed a great many of the inner parts in extracting this bone; I began to perceive the cause of this mistake, and that it was not an easy matter to separate the cranium as it ought. The common way is to divide the cranium by a circular section, to remove the upper segment; but if this segment were again divided by a section perpendicular to the former, it would be much more easily removed without doing any violence to the brain; for scissars, saws, and forceps cannot be handled without shaking and disordering the parts. A small circular saw might be contrived which would not shake the parts very much, especially if it were turned upon a proper axis placed between two pointed pillars. This saw might likewise be employed for several other purposes in separating the cranium; but if any liquor could be discovered to dissolve or soften the bones in a small space of time, this would be by far the best way of separating the cranium.

It is not sufficient to be continually attentive; we must likewise make use of different methods of dissection, which are so many different proofs of the truth of our operations, in order to satisfy ourselves and to convince others.

This will appear a very strange doctrine to those who believe that there are stated laws for the dissection of every part, and that the anatomical administrations taught us by the ancients, ought to be inviolably observed without any change or addition. I own that the ancients might have given us unalterable rules for the dissection of each part, had they been sufficiently acquainted with them themselves; but as they certainly knew less about many parts than we do, they were at least as unfit as we are, to prescribe rules which can never be fixed or constant till more discoveries have been made. It will here be objected that some method must be followed in dissecting the parts already known. This I readily grant, and also that the method of the ancients is to be made use of till a better is found out; but I would not have that method looked upon as perfect or unalterable. The principal reason why a great many anatomists have remained

mained in their mistakes, and why they have gone no greater a length than the ancients in dissection, is, because they believe that every thing has been already taken notice of, and that there is nothing left for the moderns to do; and as they have looked upon the ancient laws as inviolable rules in dissection, they spent their whole lives in demonstrating the same parts in the same manner; whereas anatomy ought to be confined by no rules, every new dissection requiring a different method. The advantage of proceeding in this manner is, that if we miss of new discoveries, we at least are put in a condition to find out any mistakes that may have happened in former dissections, especially in controverted points, in which the spectators ought to have the liberty of prescribing the rules of dissection.

This method of dissection makes indeed but a very small shew, and a man cannot well display his learning at the same time that he acknowledges his ignorance; but as for my own part, I much rather chuse to own what I do not know, than to impose upon my hearers ancient opinions, which will some time or other be demonstrated to be false. We have seen great anatomists exposed to this mortification; and we still see many who believe that more regard will be paid to their stiffness and positiveness in opinion than to ocular demonstration. I wish these gentlemen much joy of their self-conceit; while I endeavour to follow the laws of philosophy, by which we are taught to search after truth in so cautious a manner, as never to believe we have found it, till it brings demonstration along with it.

I cannot prove to you the necessity of often changing the methods of dissection better than by the two following examples. It is a confirmed experiment, that by blowing into the beginning of the fissure under the fornix, the fornix is separated from the basis, and a considerable cavity left between them; and the same thing happens when we separate the cranium with violence, as I have already said. This is so evident, that both the dissector and the spectators are fully convinced of it; but if any person should still be in doubt, there is no other way to clear it up, but to endeavour to demonstrate this cavity in another manner. For if it be natural, we must always find it the same, in whatever manner we look for it; but if by any other method you find that it is wanting,

wanting, and that the parts between which it ought to lie, are connected together without leaving any void space between them, you ought from that moment to be convinced of the falsity of the former demonstration, and that it was the force of the air to which the appearance of a cavity was owing.

If the brain is dissected according to the method of Varolius or Willis, after having taken it out of the cranium, you will commonly see the second pair of tubercles separated at the middle of that white substance which lies before the glandula pinealis, and which is very often broken. When we make the dissection, leaving the brain in the cranium, we see both the tubercles and the white substance entire, and then we see plainly that the cause of the first mistake was owing to the weight of the lateral parts which break those in the middle.

Having made a true and exact plan of the parts of the brain; having discovered the mistakes and the causes of these mistakes; and having settled the true method of demonstrating these parts, with all the necessary precautions; the next step is to express by good figures all that we have discovered; for we had better be without figures than not have them true and faithful. When we cannot have recourse to the originals, the representation serves to keep us in mind of them; and many persons never have an opportunity of seeing the parts in any other way, their aversion for blood hindering them from satisfying their curiosity by examining dead bodies; and therefore, if the figures are not true, they give false ideas to those who would learn anatomy by their help, and puzzle others who make use of them only to refresh their memory.

We ought therefore to leave nothing undone to procure exact figures; in order to which a good drawer is as necessary as a good anatomist. We must likewise apply ourselves very particularly to see in what manner we ought to dissect and dispose the parts so as to exhibit all that is to be seen in the brain, there being difficulties peculiar to this organ. The other parts require only a preparation to complete the figures we design; whereas the brain, never so well prepared, subsides before the figure can be taken; and we must have several fresh subjects, before one figure can be finished. To  
this



this perhaps it is owing that no anatomical figures are so imperfect as those of the brain.

I have hitherto said nothing of the uses of the parts nor of the animal actions, as they are called, because it is impossible to explain the movements of a machine, till we know the contrivance of its parts. A reasonable man must in his own mind laugh at these positive anatomists, who having made a long harangue about the use of parts, the structure of which is altogether unknown to them, give this as the only reason of all they advance, that God and nature do nothing in vain. They deceive themselves in the application of this general maxim; and the part which they rashly judge to have been made by God for one end, is afterwards discovered to have been made for another. We had therefore much better own our ignorance, be more reserved in our decisions, and not undertake upon such slight conjectures to explain matters which are in their own nature so difficult.

All that I have hitherto mentioned is but a very small part of what ought to be done, in order to acquire the knowledge of the brain. We ought moreover to examine the heads of all animals, and in all the different states of each animal. In the foetus of animals, we see how the brain is gradually formed; and what could not be seen in a sound healthy brain, may perhaps be discovered in one that is diseased.

In living animals we ought to consider every thing that may cause the least alteration in the actions of the brain, whether the causes be external, as from liquors, wounds, medicines, &c. or internal, as a great number of diseases reckoned up by physicians. There is likewise this advantage attending the dissection of the brains of animals, that we may manage them as we please. We may learn to trepan or to perform any other chirurgical operation upon them; we may examine whether the brain has any motion in these operations, and whether the application of any medicines to the dura mater, or to the substance or ventricles of the brain, may not produce some particular effects.

We might likewise make different trials without opening the cranium, by applying medicines exteriorly, by mixing them with the food, and by injections into the vessels, in order to discover what disturbs the animal actions, and what is most proper to restore them when disordered.

The brain is different in different animals; and this is another reason why we should examine them all. The brains of birds and fishes are not at all like that of man; and even in animals where there is the greatest likeness to the human brain, I have always found a very great variety. Whatever this difference be, it may always afford us some new light, and teach us what it is absolutely necessary we should know. In some animals, the fibres are more easily seen than in men; and the parts which in the human brain are mixed and joined together, are sometimes distinct and separate in animals; and we often meet with the substance more or less solid, and the size and situation different.

I need not insist any longer on this subject, because I believe we are all convinced that we are indebted to the dissection of animals for almost all the new discoveries of this age; and that there are many parts which would never have been found in the human brain, if they had not first been observed in animals.

What I have hitherto said concerning the insufficiency of all the systems of the brain, concerning the want of a true method in dissecting it, concerning the infinite number of inquiries that ought to be made about it in man and in brutes, in all their different states, concerning the barrenness of all the writers on this subject, and concerning the precautions that must be used in handling these tender parts, ought certainly to undeceive those who satisfy themselves with what they find in the books of the ancients. We must always remain in ignorance if we sit down with what the ancients have taught us; and if men capable of making such inquiries do not contribute their labour, industry, and study, in order to arrive at the knowledge of truth, which is the principal aim of all who search for it sincerely.

*The passages from Descartes referred to in this dissertation, are these.*

Fig. 11. For we must know that the other vessels which bring the blood from the heart, having been divided into an infinite number of small branches disposed in a reticular manner, and which are spread like a thin web in all the cavities of the brain, are collected round a certain small gland situated

ed almost in the middle of the substance of the brain at the entry of the cavities, and have in this place a great number of small holes, through which the most subtle parts of the blood which they contain, may be conveyed to the gland, because they are too small to allow the grosser parts to pass. These arteries do not terminate here, but several of them being united into one run up in a straight course to that great vessel, which like an euripus supplies all the exterior surface of the brain.

*Pag. 12.* The gland is to be looked upon as a rich source from which the finest and most agitated parts of the blood run on all hands into the cavities of the brain.

*Pag. 63.* Imagine the surface which is turned toward the cavities to be a piece of close network or plexus; all the meshes of which are so many small holes through which the animal spirits may pass; and being turned toward the gland from which all these spirits proceed, they can easily be directed toward all the different points of this gland.

*Pag. 65.* The spirits do not stop any where, but in proportion as they enter the cavities of the brain by the holes of the small gland; they run directly toward those of the small tubes which are over against them.

*Pag. 72.* In explaining how figures are marked in the spirits on the surface of the gland, he determines plainly enough the relation which he supposes to be between the inner surface of the brain and that of the gland.

*Pag. 77.* It ought likewise to be considered, that the gland is composed of a soft matter, and that it is not all united to the substance of the brain, but only connected to small arteries (the coats of which are very loose and pliable), and supported in its situation by the force of the blood in these arteries; so that a very small matter may incline it to either side, and, by so doing, dispose the spirits which it contains, to run toward one part of the brain rather than to another . . . . . If the spirits were of equal force, the gland would always be kept in an immoveable erect posture in the centre of the head.

*Pag. 77.* As the spirits flow out more readily from one part of the brain than from another, they may have force enough to turn the small tubes in the inner surface of the brain into which they run, towards the place from whence they flow out, if they do not find them in that direction.



§ 11. *Pericranium,*

196. Besides the external integuments of the head, the skin, hair, and cellular substance, there is an aponeurotic expansion which covers the head like a cap, and is spread round the neck and on the shoulders like a riding-hood; and for this reason I give it in general the name of *hood*, and I call the upper portion of it, *the aponeurotic cap*.

197. This aponeurosis is very strong on the head, and it appears to be made up at least of two strata of fibres crossing each other. As it is spread on the neck, it becomes gradually thinner, and ends insensibly on the clavicles. It sends out a production on each side, from above downward, and from without inward, which having passed over the superior extremity of the *musculus sterno mastoideus*, runs behind that muscle toward the transverse apophyses of the vertebræ of the neck, where it communicates with the *ligamenta intertransversalia*.

198. The external surface of all the bones of the head, as well as of all the other bones of the human body, except the teeth, is covered by a particular membrane, of which that portion which particularly invests the cranium is named *pericranium*, and that which invests the bones of the face is simply termed *periosteum*.

199. The pericranium is made up of two laminæ closely united together. The internal lamina which has by some been taken for a particular periosteum, covers immediately all the bony parts of this region; and the external lamina has been looked upon as a membrane distinct from the internal, and named *pericranium* particularly.

200. The external lamina of the pericranium parts from the other, at the semi-circular or semi-oval plane mentioned in the description of the skeleton, N<sup>o</sup> 182. and becomes a very strong aponeurotic or ligamentary tent, which covers the temporal muscle, and is afterwards fixed in the external angular apophysis of the *Os Frontis*, in the posterior edge of the superior apophysis of the *Os Malæ*, and in the superior edge of all the zygomatic arch, as far as the root or basis of the mastoide apophysis.

201. In the interstice between the two laminæ at this place  
lies

lies a large portion of the musculus temporalis, being inserted in each lamina in the manner already said in the description of the muscles. The rest which does not give insertion to this muscle, that is, between the lower portion of the muscle and zygomatic arch, is filled by a cellular and fatty substance. At this place, the aponeurotic hood is seen to join the external lamina of the pericranium; and they both communicate with particular aponeurotic expansions of the neighbouring muscles, the sterno mastoidæus, masseter, zygomaticus, &c.

## A R T. II.

### *The Eye.*

#### § 1. *The Eye in general.*

202. **T**HE eyes are commonly two in number, situated at the lower part of the forehead, one at each side of the root of the nose; and they are made up of hard and soft parts. The hard parts are the bones of the cranium and face, which form two pyramidal or conical cavities, like funnels, to which we give the name of *orbits*. The soft parts are of several kinds.

203. The principal and most essential soft part in each organ is the globe or ball of the eye; the others are partly external and partly internal. The external parts are the supercilia or eye brows, the palpebræ or eye lids, the caruncula lachrymalis, and the puncta lachrymalia; and the internal parts are the muscles, fat, lachrymal gland, nerves, and blood-vessels.

204. Seven bones are concerned in the composition of each orbit, viz. the Os Frontis, Os Sphenoidale, Os Ethmoides, Os Maxillare, Os Malæ, Os Unguis, and Os Palati. In each orbit we are to consider the edge, sides, and bottom. The edge is formed by the Os Frontis, Os Maxillare, and Os Malæ; the bottom by the Os Sphenoides and Os Palati; and all these bones except the Os Palati, contribute to form the sides. The bottom is perforated by the foramen opticum of the Os Sphenoides; and the external side near this foramen, by two orbitary fissures, one superior, called *sphenoidalis*, the other inferior, called *sphen-*

*no-maxillaris*, as has been already said in the description of the skeleton.

205. All the cavity of the orbit is lined by a membrane, which is an elongation or production of the dura mater; and it comes partly through the foramen opticum of the Os Sphenoides, and partly through the sphenoidal or superior orbital fissure. This membrane, which may be looked upon as the periosteum of the orbit, communicates with the periosteum of the basis ~~of~~ anii, by the inferior orbital fissure, and with the periosteum of the face at the edge of the orbit. At the upper part of the edge of the orbits, the two periosteae form a kind of broad ligament, and a narrow one at the lower part of this edge, which I shall call *ligaments of the palpebræ*.

206. The particular situation of the orbits represents nearly two funnels, placed laterally at a small distance from each other, in such a manner as that their apices are almost joined, their nearest sides almost parallel, and the other sides turned obliquely backward; and for this reason the middle of the great circumference or edge of each orbit, is at a much greater distance from the septum narium, than the bottom or apex; and the edge or great circumference is very oblique, the temporal or external angle of the orbit lying more backward than the nasal or internal angle.

## § 2. *The globe or ball of the eye.*

207. The globe of the eye being the most essential of all the soft parts belonging to the organ of sight; and *Composition.* being likewise a part which we are obliged to mention as often as we speak of the other soft parts, must be first described. It is made up of several proper parts, some of which being more or less solid, represent a kind of shell formed by the union of several membranous strata called *the coats of the globe of the eye*; and the other parts being more or less fluid, and contained in particular membranous capsulæ, or in the interstices between the coats, are termed *the humours of the globe of the eye*. These capsulæ are likewise termed *coats*.

208. The coats of the globe of the eye are of three kinds. Some form chiefly the shell of the globe; some are additional, being fixed only to a part of the globe, and some are capsular, which contain the humours. The coats which form the  
shell



shell are three in number. The external, to which the convexity of the globe is owing, is termed *tunica sclerotica* or *cornea*; the middle coat is named *choroides*, and the third or innermost, *retina*. The additional coats are two, one called *tendinosa* or *albuginea*, which forms the white of the eye, and the other, *conjunctiva*. The capsular tunicae are likewise two, the vitrea, crystallina.

209. The globe of the eye thus formed, sends out backward a pretty large pedicle, which is the continuation of the optic nerve. It is situated about the middle of the orbit in the manner which we shall afterwards see; and it is tied to it by the optic nerve, by six muscles, by the tunica conjunctiva, and by the palpebrae. The back-part of the globe, the optic nerve, and muscles, are surrounded by a soft fatty substance, which fills the rest of the bottom of the orbit.

210. The humours are three in number, the aqueous, vitreous, and crystalline. The first may properly enough be called an *humour*, and is contained in a space formed in the interstices of the anterior portion of the coats. The second or vitreous humour is contained in a particular membranous capsula, and fills above three fourths of the shell or cavity of the globe of the eye. It has been named *vitreous*, from its supposed resemblance to melted glass; but it is really more like the white of a new laid egg.

211. The crystalline humour is so called from its resemblance to crystal, and is often named simply the *crystalline*. It is rather a gummy mass than an humour, of a lenticular form, more convex on the back than on the foreside, and contained in a fine membrane called *membrana* or *capsula crystallina*. What I have here said is sufficient to give a general idea of the three humours of the globe of the eye.

### § 3. The coats of the eye in particular.

212. The most external, thickest, and strongest coat of the eye is the sclerotica or cornea, and it invests all the other parts of which the globe is composed. *Tunica sclerotica.* It is divided into two portions, one called *cornea opaca*, the other *cornea lucida*, which is only a small segment of a sphere situated anteriorly.

213. The cornea opaca is made up of several strata closely connected

connected together, and is of an hard compact texture resembling parchment. About the middle of its posterior convex portion, where it sustains the optic nerve, it is in a manner perforated, and thicker than any where else; its thickness diminishing gradually toward the opposite side, and its substance is penetrated obliquely in several places by small blood vessels. The course of the nervous filaments through this coat is very singular; they enter the convex side at some distance from the optic nerve, and running from thence through its substance, they pierce the concave side near the cornea lucida.

214. The cornea lucida called likewise simply *cornea*, the opaque portion being named *sclerotica*, is made up in the like manner of several strata or laminæ closely united, and appears to be a continuation of the opaque portion or *sclerotica*, though of a different texture. When macerated in cold water, it swells.

215. This portion is something more convex than the cornea opaca, so that it represents the segment of a small sphere added to the segment of a greater; but this difference is not equally great in all persons. The circumference of the convex side is not circular as that of the concave side, but transversely oval; for the superior and inferior portions of the circumference terminate obliquely; but this obliquity is more apparent in oxen and sheep than in man.

216. The cornea lucida is perforated by a great number of imperceptible pores, through which a very fine fluid is continually discharged, which soon afterwards evaporates; but we discover it evidently by pressing the eye soon after death, having first wiped it very clean, for we then see a gradual collection of a very subtle liquor, which forms itself into little drops; and this experiment may be several times repeated on the same subject. It is this dew that forms a kind of pellicle on the eyes of dying persons, which sometimes cracks soon after, as is observed in the memoirs of the academy for 1721.

217. The second coat of the globe of the eye is the choroides, which is of a blackish colour, more or less inclined to red, and adheres, by means of a great number of small vessels, to the cornea opaca from the insertion of the optic nerve all the way to the union of the two corneæ, where it leaves the circumference of the globe, and

and forms a perforated septum, by which the small segment of the globe is separated from the greater. This portion goes commonly by the particular name of *uvea*, which was formerly given to the whole second coat; and as it is of different colours in several subjects, it has likewise got the name of *iris*; which term, however, agrees more precisely to the coloured surface of this portion, and would even be very improper for this surface in persons where it is uniformly brown, black, or blackish.

218. The external lamina of the choroides is stronger than the internal, and both appear blackish because of their transparency. At a very small distance from the union of the two corneæ this lamina is most closely united to the cornea opaca. Round this adhesion it changes colour, and forms a whitish ring of the same breadth with the adhesion; and near the edge of the sclerotica this ring is stronger and of a different texture from what it is any where else. It adheres so closely to the sclerotica, that if we blow through a small hole made therein without touching the choroides, the air will penetrate every where between the two coats, but cannot destroy this adhesion, or pass to the cornea lucida. This adhesion has been improperly named *ligamentum ciliare*. On the inner surface of this lamina we discover a great number of flat lines in a vortical disposition, which are the vessels named by Sreno *vasa vorticosa*, or *vortices vasculosi*, of which hereafter.

219. The internal lamina of the choroides is thinner than the external; and its surface, together with the corresponding surface of the other lamina, is covered by a blackish substance with some mixture of red, which easily separates when touched, and immediately tinges the water in which the choroides is dipt. The origin of this substance has not as yet been observed; but, after a nice anatomical injection, I have observed a great number of vascular stars on the inner surface of this lamina. In Mr. Ruysch's works, it is termed *membrana Ruyschiana*.

220. The anterior portion or perforated septum of the choroides has the name of *uvea*, and the hole near the centre of this septum is called *pupilla*. The anterior lamina of the same septum is termed *iris*, and the radiated plicæ of the posterior lamina, *processus ciliares*. Between the two laminæ of the *uvea*

*Uvea, iris, pupilla,  
and processus ciliares.*



we find two very thin planes of fibres which appear to be fleshy, the fibres of one plane being orbicular, and lying round the circumference of the pupilla, and those of the other being radiated, one extremity of which is fixed to the orbicular plane, the other to the great edge of the uvea.

221. The plicæ or processus ciliares are small radiated and prominent duplicatures of the posterior lamina of the uvea, and their circumference answers partly to that of the white ring of the external lamina. They are oblong thin plates; their posterior extremities or those next the choroides, being very fine and pointed; the others, or those next the pupilla, broad, prominent, and ending in acute angles. In the duplicature of each ciliary fold we find a fine reticular texture of vessels; and some pretend to have seen fleshy fibres in the same place, lying in small grooves of the membrana vitrea, as we shall see hereafter.

222. The space between the cornea lucida and uvea, contains the greatest part of the aqueous humour, and communicates by the papilla with a very narrow space behind the uvea, or between that and the crystalline. These two spaces have been termed *the two chambers of the aqueous humour*, one anterior, the other posterior, as I shall observe in describing this humour in particular.

223. The third coat of the eye is of a very different texture from that of the other two coats. It is white, *Retina.* soft, and tender, and, in a manner, medullary, or like a kind of paste spread upon a fine reticular web. It appears to be thicker than the choroides, and reaches from the insertion of the optic nerve, to the extremities of the ciliary radii, being equally fixed to the choroides through its whole extent. At the place which answers to the insertion of the optic nerve, we observe a small depression, in which lies a sort of medullary button terminating in a point; and from this depression blood-vessels go out, which are ramified on all sides through the substance of the retina.

224. It is commonly said that the retina is a production or expansion of the medullary substance of the optic nerve; the sclerotica, of the dura mater, and the choroides, of the pia mater, which accompanies this nerve. But this opinion is not agreeable to what we observe in examining the optic nerve, and its insertion in the globe of the eye. If we take a very sharp instrument,

instrument, and divide this nerve through its whole length, between where it enters the orbit and where it enters the globe, into two equal lateral parts, and then continue this section through the middle or centre of its insertion, the following phænomena will appear.

225. That the nerve contracts a little at its insertion into the globe; that its outer covering is a true continuation of the dura mater; that this vagina is very different from the sclerotica both in thickness and texture, the sclerotica being thicker than the vagina, and of another structure; that the vagina from the pia mater forms, through the whole medullary substance of the nerve, several very fine cellular septa, and that where it enters the globe of the eye, the pia mater does not directly answer to the choroides.

226. Lastly, that as the medullary substance of the nerve enters the globe, it is very much contracted, and seems to terminate only in the small tubercle or button already mentioned, and that the retina is too thick to be taken for an expansion of the medullary substance at this place.

227. The insertion of the optic nerve in the globe of the eye is most commonly not directly opposite to the pupilla, so that the distance between these two parts is not the same when measured on all parts of the globe. The greatest distance is oftenest on the side next the temples, and the smallest, next the nose. I have observed an inequality of the same kind in the breadth of the uvea, which in many subjects is less near the nose than near the temples; so that the centre of the pupilla is not the same with that of the great circumference of the iris; and I have seen the same difference in the breadth of the corona ciliaris.

§ 4. *The humours of the eye and their capsule.*

228. The vitreous humour is a clear and very liquid gelatinous fluid contained in a fine transparent capsule, called *tunica vitrea*, together with which it forms a mass nearly of the consistence of the white of an egg. It fills the greatest part of the globe of the eye, that is, almost all that space which answers to the extent of the retina, except a small portion behind the uvea, where it forms a fossula, in which the crystalline is lodged. This

*The vitreous  
humour.*

humour

humour being dexterously taken out of the globe, preserve its consistence for some time in the capsula, almost like the white of an egg, and then runs off by little and little, till it quite disappears.

229. The tunica vitrea is composed exteriorly of two laminæ very closely connected, which quite surround the mass of humour, and are immediately applied to the retina all the way to the great circumference of the corona ciliaris; but from thence to the circular edge of the fossula of the crystalline, this coat is full of radiated sulci which contain the processus ciliares of the uvea. At the edge of the fossula the two laminæ separate, and form a particular capsula which belongs to the crystalline, as we shall see hereafter.

230. The internal lamina of the tunica vitrea gives off, through the whole substance of this humour, a great number of cellular elongations or septa so extremely fine, as not at all to be visible in the natural state, the whole mass appearing then to be uniform and equally transparent through its whole substance; but they are discovered by putting the whole soon after it is taken out of the body into some ascendent and gently coagulating liquor.

231. The radiated sulci of the tunica vitrea, which may be termed *sulci ciliares*, are perfectly black, when the coat is taken out of the body. This proceeds from the black substance with which the laminæ or processus ciliares are naturally covered, as well as all the rest of the choroides, and which remains in the bottom of the sulci, after the laminæ have been taken out. We observe very fine vessels in this humour, which shall be spoken to hereafter.

232. The crystalline is a small lenticular body of a pretty firm consistence, and transparent like crystal. It is contained in a transparent membranous capsula, and lodged in the anterior fossula of the vitreous humour, as has been already said. It is very improperly called *an humour*, because it may be handled and moulded into different shapes by the fingers, and sometimes almost dissolved by different reiterated compressions, especially when taken out of the capsula.

233. The figure of the crystalline is lenticular, but its posterior side is more convex than the anterior, the convexity of both sides being very rarely equal. The internal structure of  
this



this mass has not been hitherto sufficiently discovered, to be described with certainty, especially in man, where I could never find that contorted disposition of crystalline tubes which some pretend to have seen in the eyes of large animals.

234. The colour and consistence of the crystalline varies in different ages, as was discovered by M. Petit the physician, and demonstrated by him in the academy of sciences from a great number of human eyes; and his observations are inserted in the memoirs for 1726. Till the age of thirty it is very transparent, and almost without any colour. It afterwards becomes yellowish, and that yellowness gradually increases. The consistence varies almost in the same manner, being of an uniform softness till the age of twenty, and afterwards growing gradually more solid in the middle of the mass; but in this there are varieties explained in the memoirs for 1727.

235. The crystalline capsula or coat is formed by a duplicature of the tunica vitrea, as I have already said. The external lamina covers the anterior side of the crystalline mass; the internal lamina covers the backside, and likewise the fossula vitrea, in which the crystalline is lodged. The anterior portion of the crystalline capsula is thicker than the posterior, and, in a manner, elastic; and both its thickness and elasticity may be discovered in dissection, without any other artifice.

236. The anterior portion swells when macerated in water, and then appears to be made up of two pelliculæ, united by a fine spongy substance. I demonstrated this duplicature very plainly in the eye of an horse by the knife alone; and I even carried the separation of the two laminæ as far as the vitreous coat. Having made a small hole in the middle of the capsula, and blown into it through a pipe, some part of the air remained between the edge of the crystalline mass and that of the capsula in form of a transparent circle. This experiment was made with an ox's eye above ten years ago.

237. In examining the human eye, I have found, that the retina having reached the great circumference of the corona ciliaris becomes very thin, and is continued between the laminæ or processus ciliares of the uvea, and the ciliary sulci of the tunica vitrea, all the way to the circumference of the crystalline.

crystalline. It is perhaps this continuation which makes the *proteffus ciliaris* to be covered by a whitish pellicle, and likewise increases the thickness of the anterior portion of the *capsula crystallina*.

238. The aqueous humour is a very limpid fluid, resembling a kind of lymph or serum with a very small degree of viscosity; and it has no particular capsula like the crystalline and vitreous humours. It fills the space between the cornea lucida and uvea, that between the uvea and the crystalline, and the hole of the pupilla. These two spaces are called the *chambers of the aqueous humour*, and they are distinguished into the anterior and posterior.

239. These two chambers are not of the same extent. The anterior, which is visible to every body between the cornea lucida and uvea, is the largest; the other between the uvea and crystalline is very narrow, especially near the pupilla, where the uvea almost touches the crystalline. This proportion between the two chambers has been sufficiently proved, contrary to the opinion of many ancient writers, by M. Heister, Morgagni, and several members of the royal academy; but none has treated these matters at so great a length as M. Petit, the physician, as appears by the printed memoirs of that society.

§ 5. *The tunica albuginea and muscles of the globe of the eye.*

240. The tunica albuginea, called commonly the *white of the eye*, and which appears on all the anterior convex side of the globe, from the cornea lucida to the beginning of the posterior side, is formed chiefly by the tendinous expansion of four muscles in the manner presently to be described. This expansion adheres very close to the sclerotica, and makes it appear very white and shining, whereas the rest of it is of a dull whitish colour. It is very thin near the edge of the cornea; in which it seems to be lost, terminating very uniformly.

241. There are commonly six muscles inserted in the globe of the human eye, and they are divided, on account of their direction, into four recti and two obliqui. The recti are again divided, from their situation, into superior, inferior, internal and external; and from their functions, in-

to a levator, depressor, adductor, and abductor. The two oblique muscles are denominated from their situation and size, one being named *obliquus superior*, or *major*, the other *obliquus inferior*, or *minor*. The obliquus major is likewise called *trochlearis*, because it passes through a small cartilaginous ring, as over a trochlea or pulley.

242. The muscoli recti do not altogether answer to that name; for in their natural situation they do not at all lie in a streight direction, as they are commonly represented in an eye taken out of the body. To understand this, we ought to have a just idea of the situation of the globe in the orbit, and at the same time, to remember the obliquity of the orbits, as already explained. The globe is naturally placed in such a manner, as that, during the inaction or equilibrium of all the muscles, the pupilla is turned directly forward; the inner edge of the orbit is opposite to the middle of the inside of the globe; the outer edge of the orbit, because of its obliquity, is behind the middle of the outside of the globe; and lastly, the great circumference of the convexity of the globe between the pupilla and the optic nerve, runs directly inwards and outwards, upwards and downwards.

243. In this situation, the internal rectus alone is in a streight direction, the other three being oblique; and the external rectus is the longest, the internal the shortest, and the superior and inferior of the same middle length between the two former. The external rectus is likewise bent round the outer convex side of the globe, the superior and inferior are also incurvated, but in a less degree, whereas the whole internus is almost streight; notwithstanding all this, I shall still continue to give them all the common name of *musculi oculi recti*.

244. These muscles are fixed by their posterior extremities at the bottom of the orbit near the foramen opticum in the elongation of the dura mater, by short narrow tendons, in the same order in which I have already named them. From thence they run wholly fleshy, toward the great circumference of the convexity of the globe, between the optic nerve and cornea lucida, where they are expanded into flat broad tendons which touch each other, and afterwards unite. These tendons are fixed first of all by a particular insertion in the circumference just mentioned, and afterwards continue their



their adhesion all the way to the cornea, forming the tunica albuginea, as has been already said.

245. The superior oblique muscle is fixed to the bottom of the orbit, by a narrow tendon, in the same manner as the recti, between the rectus superior and internus. From thence it runs on the orbit opposite to the interstice between these two muscles, toward the internal angular apophysis of the Os Frontis, where it terminates in a thin tendon, which having passed through a kind of ring as over a pulley, runs afterwards in a vagina obliquely backward under the rectus superior, that is, between that muscle and the globe; and increasing in breadth it is inserted posteriorly and laterally in the globe, near the rectus externus.

246. The ring through which this muscle passes, is partly cartilaginous and partly ligamentary. The cartilaginous portion is flat, of a considerable breadth, and like half a ring. The ligamentary portion adheres strongly to the two ends of the cartilage, and is fixed in the small fossula which lies in the orbit, on the angular apophysis of the Os Frontis. By means of this ligament, the ring is in some measure moveable, and yields to the motions of the muscle. To the anterior edge of the ring, a ligamentary vagina is fixed, which invests the tendon all the way to its insertion in the globe.

247. The obliquus inferior is situated obliquely at the lower side of the orbit, under the rectus inferior, which consequently lies between this muscle and the globe. It is fixed by one extremity a little tendinous, to the root of the nasal apophysis of the Os Maxillare, near the edge of the orbit between the opening of the ductus nasalis, and the inferior orbital fissure.

248. From thence it passes obliquely, and a little transversely backward, under the rectus inferior, and is fixed in the posterior lateral part of the globe by a flat tendon, opposite to, and at a small distance from the tendon of the obliquus superior, so that these two muscles do in some measure surround the outer posterior part of the globe.

*Uses of these muscles.*

249. The rectus superior moves the anterior portion of the globe upward when we lift up the eyes; the rectus inferior carries this portion downward;

downward; the internus, toward the nose; and the externus, toward the temples.

250. When two neighbouring recti act at the same time, they carry the anterior portion of the globe obliquely toward that side which answers to the distance between these two muscles; and when all the four muscles act successively, they turn the globe of the eye round, which is what is called *rolling the eyes*.

251. It is to be observed, that all these motions of the globe of the eye are made round its centre, so that in moving the anterior portion all the other parts are likewise in motion. Thus when the pupilla is turned toward the nose or upward, the insertion of the optic nerve is at the same time turned toward the temple, or downward.

252. The use of the oblique muscles is chiefly to counterbalance the action of the recti, and to support the globe in all the motions already mentioned. This is evident from their insertions, which are in a contrary direction to those of the recti, their fixed points with relation to the motions of the globe being placed forward, and those of the recti backward, at the bottom of the orbit. The soft fat which lies behind the globe is altogether insufficient to support it; neither is the optic nerve more fit for this purpose; for I have shewn that this nerve follows all the motions of the globe which would be impossible, were not the fat very pliable, and without resistance. And to this we must add, that the optic nerve at its insertion in the globe has a particular curvature, which allows it to be elongated, and consequently prevents it from suffering any violence in the different motions of the eyes.

253. The obliquity of these two muscles does not hinder them from doing the office of a fulcrum, because this is not a fulcrum distinct from the part moved, or on which the globe of the eye slides like the head of one bone in the articular cavity of another, but being fixed to the part, it easily accommodates itself to all the degrees of motion thereof. Had these muscles lain in a straight direction, they would have incommoded the recti, but their obliquity may be said to be in some measure rectified by the inner surface of the orbit, and the rectus externus.

254. The inner surface of the orbit serves for a kind of  
 VOL. II. 3 C collateral

collateral fulcrum, which hinders the globe from falling too far inward; as the joint action of the two obliqui prevents it in part from falling too far outward. The rectus externus, by being bent on the globe, not only hinders it from being carried outward, but also prevents the indirect motions of the obliqui from thrusting it out of the orbit toward the temples. The other uses attributed to these muscles seem to me to be without foundation, from the consideration of their insertions, and of the structure of the parts with which they are concerned; both which reasons are explained in the memoirs of the academy for 1721.

§ 6. *The supercilia, and musculi frontales, occipitales, and superciliares.*

255. The supercilia or eye-brows are the two hairy arches situated at the lower part of the forehead, between the top of the nose and temples in the same direction with the bony arches which form the superior edges of the orbits. The skin in which they are fixed does not seem to be much thicker than that of the rest of the forehead; but the membrana adiposa is thicker than on the neighbouring parts. The extremity of the eye-brows next the nose is called the *head*, as being larger than the other extremity, which is named their *tail*. Their colour is different in different persons, and often in the same person, different from that of the hair on the head; neither is the size of them always alike. The hairs of which they consist are strong and pretty stiff, and they lie obliquely, their roots being turned to the nose, and their points to the temples.

256. The supercilia have motions common to them with those of the skin of the forehead, and of the hairy scalp. By these motions the eye-brows are lifted up, the skin of the forehead is wrinkled more or less regularly and transversely; and the hair and almost the whole scalp is moved, but not in the same degree in all persons; for some by this motion alone can move their hat, and even throw it off from their head. The eye-brows have likewise particular motions which contract the skin above the nose; and all these different motions are performed by the following muscles.

257. The frontal muscles are two thin, broad fleshy planes

of



of unequal lengths, lying immediately behind the skin and membrana adiposa, on the anterior parts of the forehead, which parts they cover from the root of the nose, and through about two thirds of the arch of the eye-brows on each side, all the way to the lateral parts of the hair on the forehead. At the root of the nose they touch each other as if they were but one muscle; and at this place their fibres are short and longitudinal, or vertical.

*Musculi frontales.*

258. The next fibres on each side become gradually longer and more oblique, the most anterior being always the shortest and straightest; and the lateral, the longest and turned most obliquely toward the temples at their upper extremities. By this disposition an angular interstice is formed between the place where the two muscles join, and the hair on the middle of the forehead; but this disposition is not the same in all subjects, no more than the wrinkles and bounds of the hair on the forehead.

259. These muscles are fixed by the inferior extremities of their fleshy fibres immediately in the skin, running through the membrana adiposa. They cover the musculi superciliares, and adhere closely to them by a kind of intertexture. By the same fibres they seem to be inserted in the angular apophyses of the Os Frontis, and to be blended a little with the muscles of the palpebræ and nose. The upper extremities of their fleshy fibres are fixed in the external or convex surface of the pericranium. Each of their lateral portions covers a portion of the temporal muscle on the same side, and adheres very closely to it. The superior and inferior insertions are graduated.

260. The occipital muscles are too small, thin, broad, and very short fleshy planes, situated on the lateral parts of the occiput, at some distance from each other. They are inserted by the inferior extremities of their fleshy fibres in the superior transverse line of the Os Occipitis, and also a little above it. From thence they run up obliquely from behind forward, and are fixed in the inner or concave surface of the pericranium.

*Musculi occipitales.*

261. The breadth of these muscles reaches from the posterior middle part of the occiput, toward the mastoide apophysis, and they diminish unequally in length as they approach

proach these apophyses. From this inequality in length each of them appears as if it were double in some subjects; and in others they are so thin and pale, that they seem to be wanting. They are sometimes covered by an aponeurotic expansion of the trapezii.

262. The occipital and frontal muscles appear to be true digastrici, both in regard to their insertions in the pericranium, and in regard to their action. Their insertions in the pericranium are opposite, one being on the outside, the other on the inside; so that this membrane or aponeurosis may be considered as a middle tendon of four single muscles, that is, which have their fleshy fibres fixed only to one side of their tendons. The fixed insertions of the occipitales at the lower part of the occiput, and the moveable insertions of the frontalis in the skin of the forehead and of the supercilia, being well considered, together with their reciprocal insertions in the same aponeurosis, seem to be a very convincing proof that they are digastric muscles.

263. These four muscles seem always to act in concert, the occipitales being only auxiliaries or assistants to the frontales, the office of which is to raise the supercilia, by wrinkling the skin of the forehead; these wrinkles following the direction of the eye-brows pretty regularly in some subjects, and very irregularly in others.

264. To be convinced of the co-operation of these four muscles, we need only hold the hand on the occipitales, while we raise the eye-brows and wrinkle the forehead several times; and we will perceive the occipitales to move each time, though not in the same degree in all subjects. In some persons the occipitales seem to be relaxed, while the frontales being in contraction move the whole scalp and pericranium forward, and then contract to bring them back to their natural situation.

*Musculi superciliares.* 265. The musculi superciliares are fleshy fasciculi situated behind the supercilia, and behind the inferior portion of the musculi frontales from the root of the nose to above one half of each superciliary arch. They are strongly inserted, partly in the synarthrosis of the *Ossa Nasi* with the *Os Frontis*, where they come very near the proper muscles of the nose, and partly in a small neighbouring portion of the orbit. From thence they first run

run up a little, and afterwards more or less in the direction of the eye-brows. They are made up of several small fasciculi of oblique fibres, all fixed by one end in the manner already said, and by the other partly in the lower extremity of the muscles by which they are covered, and partly in the skin of the supercilia. This last portion is easily confounded with a portion of the musculus orbicularis palpebrarum.

266. The action of these muscles is to depress the eye-brows, to bring them close together, and to contract the skin of the forehead immediately above the nose, into longitudinal and oblique wrinkles, and the skin which covers the root of the nose, into irregular transverse wrinkles. This action, as well as that of the frontales, and of the muscles of the nose and lips, is not always arbitrary, but sometimes mechanical and involuntary. These muscles may perhaps likewise serve to keep the muscoli frontales in æquilibrio during their inaction, they being moveable by both extremities.

§ 7. *The palpebræ and membrana conjunctiva.*

267. The palpebræ are a kind of veils or curtains placed transversely above and below the anterior portion of the globe of the eye; and accordingly there *Palpebræ.* are two eye-lids to each eye, one superior, the other inferior. The superior is the largest and most moveable in man; the inferior the smallest and least moveable. They both unite at each side of the globe, and the places of their union are termed *angles*, one large and internal which is next the nose, the other small or external which is next the temples.

268. The palpebræ are made up of common and proper parts. The common parts are the skin, epidermis, and membrana adiposa. The proper *Structure of the palpebræ.* parts are the muscles, the tarfi, the puncta or foramina lacrymalia, the membrana conjunctiva, the glandula lacrymalis, and the particular ligaments which sustain the tarfi. The tarfi and their ligaments are in some measure the basis of all these parts.

269. The tarfi are thin cartilages forming the principal part of the edge of each palpebra; and they are *Tarfi.* broader at the middle than at the extremities. Those of the superior palpebræ are something less than half an inch in



in breadth; but in the lower palpebræ they are not above the sixth part of an inch; and their extremities next the temples are more slender than those next the nose.

270. These cartilages are suited to the borders and curvature of the eye-lids. The lower edge of the superior cartilage and the upper edge of the inferior, terminate equally, and both may be termed the *ciliary edges*. The opposite edge of the upper tarsus is something semicircular between its two extremities; but that of the inferior tarsus is more uniform, and both are thinner than the ciliary edges. Their inner sides or those next the globe are grooved by several small transverse channels, of which hereafter; and the extremities of both cartilages are connected by a kind of small ligaments.

271. The broad ligaments of the tarsi are membranous elongations formed by the union of the periosteum of the orbits and pericranium along both edges of each orbit. The superior ligament is broader than the inferior, and fixed to the superior edge of the upper cartilage, as the inferior is to the lower edge of the lower cartilage, so that these ligaments and the tarsi taken alone or without the other parts, represent palpebræ. This discovery I first communicated in my private courses.

272. The membrana conjunctiva is generally described among the coats of the globe of the eye; and I also mentioned it there, but have referred the description of it to that of the palpebræ. It is a thin membrane, one portion of which lines the inner surface of the palpebræ, that is, of the tarsi and their broad ligaments. At the edge of the orbit it has a fold, and is continued from hence on the anterior half of the globe of the eye, adhering to the tunica albuginea; so that the palpebræ and the forepart of the globe of the eye are covered by one and the same membrane, which does not appear to be a continuation of the pericranium, but has some connection with the broad ligaments of the tarsi.

273. The name of *conjunctiva* is commonly given only to that part which covers the globe, the other being called simply the *internal membrane of the palpebræ*; but we may very well name the one *membrana oculi conjunctiva*, and the other

*membrana*

*membrana palpebrarum conjunctiva.* That of the palpebræ is a very fine membrane adhering very close, and full of small capillary blood-vessels. It is perforated by numerous imperceptible pores, through which a kind of serum is continually discharged; and it has several very evident folds which shall be spoken to hereafter.

274. The conjunctiva of the eye adheres by the intervention of a cellular substance, and is consequently loose, and as it were moveable; and it may be taken hold of, and separated in several places from the tendinous coat. It is of a whitish colour, and being transparent, the albuginea makes it appear perfectly white; these two coats together forming what is called *the white of the eye*. The greatest part of the numerous vessels which run upon it contain naturally only the serous part of the blood, and consequently are not discoverable, except by anatomical injections, inflammations, obstructions, &c. With the point of a good knife we continue the separation of this membrane over the cornea lucida.

275. The lacrymal gland is white, and of the number of those called *conglomerate glands*. It lies under that depression observable in the arch of the orbit near the temples, mentioned in the description of the skeleton, No 199. and laterally above the globe of the eye. It is a little flattened, and divided as it were into two lobes, one of which lies toward the insertion of the musculus rectus superior; the other toward the rectus externus. It adheres very closely to the fat which surrounds the muscles, and posterior convexity of the eye, and it was formerly named *glandula innominata*.

*Glandula lacrymalis.*

276. From this gland several small ducts go out, which run down almost parallel to each other, through the substance of the tunica interna or conjunctiva of the superior palpebra, and afterwards pierce it inwardly near the superior edge of the tarsus. These ducts are very difficult to be found; but the best way to discover them, is to let the superior palpebra lie for a little while in cold water, and then without wiping it, to blow on several places of the surface of the membrane, through a small tube held very near, but so as not to touch it, that the air may fill some of the orifices of the ducts, and so discover them.

277. The

277. The borders of each palpebra taken all together are formed by the edge of the tarsus, and by the union of the internal membrane, with the skin and epidermis. This border is flat, and of some sensible breadth from within about a quarter of an inch of the internal angle, all the way to the external angle, near which the breadth diminishes. This breadth is owing only to the thickness of the palpebræ, which at this place have their edges oblique or slanting, in such a manner as when the two palpebræ touch each other slightly, a triangular space or canal is formed between them and the globe of the eye.

278. The flat edge of each palpebra is adorned with a row of hairs called *cilia*, or *the eye-lashes*. Those belonging to the superior palpebra are bent upward, and longer than those of the lower palpebra which are bent downward. These rows are placed next the skin, and are not single, but irregularly double or triple. The hairs are longer near the middle of the palpebræ than toward the extremities, and for about a quarter of an inch from the inner angle, they are quite wanting.

279. Along the same border of the palpebræ near the internal membrane, or toward the eye, we see a row of small holes which may be named *Glandulæ ciliares*. They are the orifices of the same number of small oblong glands which lie in the sulci, channels or grooves on the inner surface of the tarsus. These little glands are of a whitish colour, and when examined through a single microscope, they appear like bunches of grapes, those of each bunch communicating together. And when they are squeezed between two nails, a sebaceous matter like soft wax, is discharged through the *puncta ciliaria*.

280. Near the great or internal angle of the palpebræ the flat portion of their edges terminates in another which is rounder and thinner. By the union of these two edges an angle is formed, which is not perfectly pointed like a true angle, but rounded, and yet it ought not to be termed an *obtuse angle*, because that expression in the mathematical style means something different. For the same reason the name of *great angle* is improper; and we had better call it *the internal or nasal angle*.

281. At



281. At this place, the extremity of the flat portion is distinguished from the round portion by a small protuberance or papilla, which is obliquely perforated by a small hole in the edge of each palpebra. These two small holes are very visible, and often more so in living than in dead bodies, and they are commonly named *puncta lacrymalia*, being the orifices of two small ducts which open beyond the angle of the eye into a particular reservoir, termed *sacculus lacrymalis*, which shall be described in the article of the nose.

282. The *puncta lacrymalia* are opposite to each other, and so they meet when the eye is shut. Round the orifice of each of these points, we observe a whitish circle which seems to be a cartilaginous appendix of the tarsus, and which keeps the orifice always open. These two oblique circles are so disposed, that when the eye is but slightly shut, they touch each other only toward the skin, and not toward the globe of the eye. The fine membrane which covers these circles, and passes through the *puncta* into the ducts, seems sometimes to run into gathers when it is touched with a stilett. This observation was first made by the late M. Sant Yves a Parisian oculist.

283. The *caruncula lacrymalis* is a small reddish, granulated, oblong body, situated precisely between the internal angle of the palpebræ and globe of the eye, but it is not fleshy as its name would insinuate. The substance of it seems to be wholly glandular; and it appears through a single microscope, in the same manner as the other conglomerate glands. We discover upon it a great number of fine hairs covered by an oily, yellowish matter; and on the globe of the eye, near this glandular body, we see a semilunar fold formed by the conjunctiva, the concave side of which is turned to the uvea, and the convex side to the nose. This fold appears most when the eye is turned toward the nose.

*Caruncula lacrymalis.*

§ 8. *The muscles of the palpebræ.*

284. The muscles of the palpebræ are commonly reckoned to be two, one peculiar to the upper eye lid, named *levator palpebræ superioris*; the other common to both, called

*musculus orbicularis palpebrarum*, which has been subdivided in different manners, as we shall see presently.

285. The levator palpepræ superioris is a very thin muscle situated in the orbit above and along the rectus superior oculi. *Levator proprius.* It is fixed to the bottom of the orbit, by a small narrow tendon, near the foramen opticum between the posterior insertions of the rectus superior, and obliquus superior. From thence its fleshy fibres run forward on the rectus, increasing gradually in breadth, and terminate by a very broad aponeurosis, in the tarsus of the superior palpebra.

286. By the *musculus palpebrarum obliquus* we understand all that extent of fleshy fibres, which by a thin stratum surrounds the edge of each orbit, and from thence, without any interruption, covers the two palpebræ all the way to the cilia. *Orbicularis palpebrarum.* The fibres which run upon the edge of the orbit are nearly orbicular; but most of those which cover the palpebræ are transversely oval.

287. Almost all of them have a common tendon situated transversely between the internal angle of the eye, and the nasal apophysis of the Os Maxillare. This is a slender ligamentary tendon, strongest where it is fixed in the bone, and diminishing gradually as it approaches the angle of the palpebræ, where it terminates at the union of the points, or at the extremities of the two tarsi. The fleshy fibres are fixed to it anteriorly, so that at the first sight it appears to be no more than a linea alba.

288. From thence one portion of the fibres is turned upward, the other, downward, and both meet again at the external angle, being united by a particular kind of intertexture, very difficult to be explained. When having inverted this portion of the muscle, we examine its posterior surface, we observe a small thin tendinous rope which runs through the fleshy fibres, and divides them all the way from the union of the two tarsi, to the temporal edge of the orbit, where it disappears; the fibres which lie beyond it appearing to continue the main circuit of the muscle.

289. I divide this muscle into four portions, whereof the first is that which surrounds the orbit, and which does not appear to be interrupted toward the temples; the upper part of

of it lying between the supercilia and the lower part of the muscoli frontales. The second portion is that which lies between the upper edge of the orbit and the globe of the eye, and which covers the inferior edge of the orbit below, some of its fibres being fixed to both edges of the orbit. Riolan divided this into two semicircular portions, one superior, the other inferior; the first lying between the musculus superciliaris and the lower part of the musculus frontalis, to both which it adheres very much.

290. The third portion seems to belong more particularly to the palpebræ, and the greatest part of it is spent in the palpebra superior. The fibres of this portion meet at the two angles of the eye, where they appear to make very acute inflexions without any discontinuation; but when examined on the other side next the globe of the eye, they have in some subjects appeared to me to be distinguished into superior and inferior. The greatest part of these fibres form a transversely oval circumference, the shortest diameter of which is longer when the eyes are open than when shut.

291. The fourth portion is an appendix to the third, from which it differs chiefly in this, that its fibres do not reach to the angles, and form only small arches, the extremities of which terminate in each palpebra. This portion is really divided into two, one for the edge of the upper eye-lid, the other for that of the lower. Riolan names this portion, *musculus ciliaris*.

292. All these different portions of the orbicular muscle adhere to the skin, which covers it from the upper part of the nose to the temples, and from the supercilium to the upper part of the cheek. When they contract, several wrinkles are formed in the skin, which vary according to the different direction of the fibres; those under the lower palpebra are very numerous, and run down very obliquely from before backward.

293. The skin of the superior palpebra is folded archwise, almost in a parallel direction to that of the semioval fibres; the plicæ intersecting the levator; whereas the other folds only intersect the orbicularis. The radiated and oblique plicæ seldom appear in young persons, except when the first and second portions of the orbicularis are in action; but in aged persons the marks thereof are visible at all times.



294. In man, the superior palpebra has much more motion than the inferior. The small, simple motions called *twinkling*, which frequently happen, though not equally often in all subjects, are performed in the upper palpebra, by the alternate contraction of the levator and superior palpebral portion of the musculus orbicularis; and in the lower palpebra at the same time or alternately, by the inferior palpebral portion of the orbicularis; but as there is but a small number of fibres in this portion, these motions are but very inconsiderable in this eye-lid.

295. These slight motions, especially those of the upper palpebra, are not very easy to be explained according to the true structure of the part. The motions which wrinkle the palpebræ, and which are commonly performed to keep one eye very close shut, while we look stedfastly with the other, are explicable by the simple contraction of all the portions of the orbicularis. These motions likewise depress the supercilia, which consequently may be moved in three different manners, upwards by the muscoli frontales, downward by the orbiculares, and forward by the superciliares. I shall take another occasion to explain the difficulties here mentioned.

§ 9. *The vessels of the eye and of its appendages.*

296. The external carotid artery by means of the arteria maxillaris externa, and the temporal and frontal arteries, give several ramifications to the integuments which surround the eye, and to all the portions of the musculus orbicularis; and these ramifications communicate with those which are distributed to the membrana conjunctiva palpebrarum, and to the caruncula.

297. The same external carotid, by means of the arteria maxillaris interna, sends a considerable branch into the orbit through the inferior orbitary or sphenomaxillary fissure; which is distributed to the periosteum of the orbit, to the muscles of the globe of the eye, to the levator palpebræ superioris, to the fat, glandula lacrymalis, membrana conjunctiva both of the eye and palpebræ, the caruncula, &c. It communicates with the internal carotid, and sends a small  
artery

artery to the ethmoidal cells of the nose, through the small, internal, posterior orbital hole.

298. The internal carotid artery having entered the cranium, sends off small rami which accompany the optic nerve, and those which pass through the fissura spheeno-maxillaris. One of these small arterial branches runs into the substance of the optic nerve, and produces on the retina, the small arteries which appear very plainly on the inner sides of that membrane. The rest join the ramifications of the external carotid already mentioned, and having penetrated into the substance of the tunica sclerotica on the backside, and run for a little way through that substance, they perforate this coat inwardly in five or six places, at an equal distance from the optic nerve and the pupilla.

299. Afterwards they perforate the external lamina of the choroides in the same number of places, and form between that and the internal lamina, the vasa vorticosa of Steno, and the vascular stellæ mentioned in the description of this internal lamina. Some small vascular filaments from these ramifications, are likewise observed to adhere very closely to the tunica vitrea; and before they form the vasa vorticosa, they send small arteries in a direct course to the circumference of the uvea, where they form a vascular circle, which sends out capillaries as far as the membrana crystallina, which are very easily injected in new-born children.

300. The veins of all these parts answer nearly to the arteries. The internal veins unload themselves, partly into the internal jugular vein, by the sinus orbitarii, cavernosi, and petrosi, and partly into the external jugular vein by the vena angularis, or maxillaris externa, the maxillaris interna, temporalis, &c.

301. Besides the capillary vessels, easily distinguishable by the red colour of the blood, there are great numbers of those which admit nothing but the serous and lymphatic parts of the blood, and consequently do not appear in the natural state. They become visible in some places by inflammations and injections, as on the membrana conjunctiva of the eye; but these contrivances do not discover them every where in aged persons. In a foetus and in new-born children a fine injection has succeeded so well as to discover the vessels of the membrana crystallina and vitrea; and in a foetus of about

fix months, the injected liquor seemed to me to have penetrated a part of the crystalline and vitreous humour.

§ 10. *The nerves of the eye and of its appendages*

302. I shall in this paragraph repeat and illustrate what has been already said in the description of the nerves, concerning those of the eye. Besides the optic nerve already described, the globe of the eye receives several small ones, which run on each side along and about the optic nerve, from its entry into the orbit to its insertion in the globe. These filaments come chiefly from a small lenticular ganglion, formed by very short rami of the orbitary or ophthalmic branch of the fifth pair, and by a branch of the third pair, or *motores oculi*.

303. These nervous filaments of the lenticular ganglion having reached the globe of the eye, are divided into five or six fasciculi, which having surrounded the optic nerve, and penetrated and perforated the cornea opaca or sclerotica, run, at distances more or less equal, between the sclerotica and choroides towards the uvea. There, each of them is divided into several short filaments, which terminate in the substance of the uvea. These small nerves which run from behind forward between the sclerotica and the choroides, have formerly been taken for particular ligaments, by very great anatomists.

304. The nerves which go to the other parts belonging to the eye, come from the third, fourth, sixth, and first two branches of the fifth pair of nerves of the medulla oblongata, and likewise from the portio dura of the seventh pair. The third, fourth, and sixth pairs give nerves to the muscles of the globe of the eye. The two branches of the fifth pair, and the portio dura of the seventh, give nerves not only to the other parts which surround the globe, but also to the muscoli frontales and internal parts of the nose.

305. The trunk of the third pair, or *motores oculi*, having entered the orbit through the superior orbitary or sphenoidal fissure, produces four branches. The first runs upward and divides into two, one for the musculus rectus superior, and the other for the levator palpebræ superioris. The trunk continuing its course, gives off the second short branch to the rectus



rectus inferior. The third branch is long and goes to the obliquus inferior, contributing likewise to the formation of the lenticular ganglion already mentioned. The fourth branch is large and supplies the rectus internus.

306. The first branch of the fifth pair, commonly termed *nervus ophthalmicus*, divides into three rami, as it enters the orbit; and sometimes only into two, one of which is afterwards subdivided. Of these three branches one is superior, which I term *nervus superciliaris*; one internal, termed *nasalis*, and one external, to which the name of *temporalis* agrees better than that of *lacrymalis*, which may occasion a mistake.

307. The superior or superciliary ramus runs along the whole periosteum of the orbit, and having passed through the superciliary notch or foramen of the Os Frontis, is distributed to the musculus frontalis, superciliaris, and superior portion of the orbicularis palpebrarum; and it communicates with a small branch of the portio dura of the seventh pair.

308. The internal or nasal branch passes under the ramification of the nerve of the third pair, and running toward the nose, is distributed thereto, and to the neighbouring parts of the orbicularis, the caruncula, &c. This branch sends off a filament, which passing through the internal, anterior, orbitary hole, enters the cranium, and presently returns again through one of the ethmoidal holes, to the internal parts of the nose. I have sometimes observed this nasal ramus to communicate with the ramus superciliaris by a particular arch, before it enters the orbitary hole.

309. The external or temporal ramus, which is sometimes a subdivision of the superciliaris, is distributed to the glandula lacrymalis, and sends off a filament which pierces the orbitary apophysis of the Os Malæ.

310. The second branch of the fifth pair, called *nervus maxillaris superior*, send off a ramus through the bony canal of the lower part of the orbit, which going out at the anterior inferior orbitary hole, is distributed to the neighbouring portion of the musculus orbicularis, and communicates with a ramus of the portio dura. I shall here say nothing of the other distributions of this branch of the maxillaris superior.

311. The portio dura of the seventh pair, or auditory nerve which I call *nervus sympatheticus minor*, gives branches to the superior, inferior, and external lateral parts of the orbicularis palpebrarum,

palpebrarum, one of which communicates with the *nervus superciliaris*, and another with the *sub-orbitarius*, as I observed in the description of the nerves.

§ 11. *The uses of the eye and of its appendages in general.*

312. Every body knows that the eye is the organ of vision. The transparent parts of the globe modify the rays of light, by different refractions; the retina and choroides receive the different impressions of these rays; and the optic nerve carries these impressions to the brain. When objects are at a great distance or obscure, the pupilla is dilated; and it is contracted when objects are near, or placed in a great light. The muscles of the globe of the eye and of the palpebræ perform the motions already described.

313. The glandula lacrymalis continually moistens the forepart of the globe of the eye; and the lachrymal serum is equally spread over that globe by the motions of the superior palpebra, the inner surface of which is in a small measure villous. The union of the two palpebræ directs this serum towards the puncta lacrymalia; and the unctuous matter discharged through the foramina ciliaria hinders it from running out between the palpebræ. The large size and viscid surface of the caruncula prevents it from running beyond the puncta, and thus forces it into them.

314. The supercilia may hinder sweat from falling on the eye. The superior cilia which are longer than the inferior may have the same use, and they both serve to prevent dust, insects, &c. from entering the eyes when they are only a little open.

### A R T. III.

#### *The Nose.*

*Division.* 315. **T**HE parts of which the nose is made up, may be divided two different ways, *viz.* from their situation, into internal and external parts; and from their structure, into hard and soft parts.

316. The external parts are the root of the nose, the arch, the

the back or spine of the nose, the sides of the nose or of the arch, the tip of the nose, the alæ, the external nares, and the part under the septum.

317. The internal parts are the internal nares, the septum narium, the circumvolutions, the conchæ superiores, the conchæ inferiores, the posterior openings of the internal nares, the sinus frontales, sinus maxillares, sinus sphenoidales, the ductus lacrymales, and ductus palatini.

318. The firm or hard parts are mostly bony, and the rest cartilaginous, viz. the Os Frontis, Os Ethmoides, Os Sphenoides, Offa Maxillaria, Offa Nasi, Offa Unguis, Offa Palati, vomer, conchæ inferiores, and the cartilages. To these we may add the periosteum and perichondrium, as parts belonging to the bones and cartilages.

319. The soft parts are the integuments, muscles, sacculus lacrymalis, membrana pituitaria, vessels, nerves, and hairs of the nares. The bony parts have been all explained in the description of the skeleton; and therefore I need only in this place set down the distribution and disposition thereof, for the formation of some of the principal parts. The septum is formed by the descending lamina of the Os Ethmoides, and by the vomer; and it is placed in the groove framed by the cristæ of the Offa Maxillaria, and rising edges of the Offa Palati described in sect. 1. N<sup>o</sup> 279. 316. The back of the nose is formed by the Offa Nasi, and the sides, by the superior apophyses of the Offa Maxillaria.

320. The internal nares, or the two cavities of the nose, comprehend the whole space between the external nares and posterior openings, immediately above the arch of the palate, from whence these cavities reach upward as far as the lamina cribrosa of the Os Ethmoides, where they communicate forward, with the sinus frontales, and backward, with the sinus sphenoidales. Laterally, these cavities are bounded on the inside by the septum narium, and on the outside or that next the cheeks, by the conchæ, between which they communicate with the sinus maxillaris.

321. The particular situation of these cavities deserves our attention. The bottom of them runs directly backward, so that a straight and pretty large stile may easily be passed from the external nares, under the great apophysis of the occipital bone. The openings of the maxillary sinuses are



nearly opposite to the upper edge of the *Ossa Malarum*. The openings of the frontal sinuses are more or less opposite to, and between the pulleys or rings of the *musculi trochleares*; and by these marks the situation of all the other parts may be determined.

322. The inferior portion of the external nose is composed of several cartilages, which are commonly five in number, and of a pretty regular figure. The rest are only additional, smaller, more irregular, and the number of them more uncertain. Of the five ordinary cartilages, one is situated in the middle, the other four laterally. The middle cartilage is the most considerable, and supports the rest, being connected immediately to the bony parts; but the other four are connected to the middle cartilage, and to each other, by means of ligaments.

323. The principal cartilage of the nose consists of three parts, one middle and two lateral. The middle portion is a broad cartilaginous lamina, joined, by a kind of symphysis, to the anterior edge of the middle lamina of the *Os Ethmoides*, to the anterior edge of the vomer, and to the anterior part of the groove formed by the *Ossa Maxillaria*, as far as the nasal spines of these bones. This lamina completes the *septum narium*, and indeed forms the principal part thereof.

324. The lateral portions are oblique and narrow, suited to the corresponding parts of the bony arch. Where they join the middle lamina, a superficial groove is observable, which makes them sometimes appear like two distinct pieces, separated from the lamina, though they are really continuous. This shallow groove terminates below by a small crista.

325. The lateral cartilages are two, on each side of the inferior part of the lamina, one anterior, the other posterior. The two anterior cartilages are very much bent forward, and form what is called the *tip of the nose*; the space between their incurvated extremities being commonly filled with a kind of fatty substance. The two posterior cartilages form the alæ of the nares, being pretty broad and of an irregular figure.

326. The spaces left between some portions of the anterior and posterior cartilages, those between the posterior cartilages and the neighbouring parts of the *Ossa Maxillaria*, and lastly, those between these four lateral cartilages and the principal lamina, vary in different subjects, and are filled by small additional

tional

tional cartilages, the number, size, and figure of which are as variable as the interstices in which they lie.

327. The sub-septum or portion under the septum narium, is a pillar of fat applied to the inferior edge of the cartilaginous partition, in form of a soft, moveable appendix. The thickness of the alæ narium, and especially that of their lower edges, is not owing to the cartilages which are very thin, but to the same kind of solid fat with which these cartilages are covered. The great cartilage is immoveable by reason of its firm connection to the bony parts of the nose; but the lateral cartilages are moveable, because of their ligamentary connections, and they are moved in different manners by the muscles belonging to them.

328. The external nose is covered by the common integuments, the skin, epidermis, and fat. These which cover the tip of the nose and alæ narium are a great number of glandular bodies, called *glandulæ sebaceæ* by M. Morgagni, the contents of which may easily be squeezed out by the fingers. All these bony and cartilaginous parts have likewise the common periosteum or perichondrium.

329. Six muscles are commonly reckoned to belong to the nose; two recti, called also *pyramidales* or *triangulares*; two obliqui or laterales, and two transversi or myrtiformes. In very muscular bodies there are likewise some supernumerary muscles or small accessorii. The nose may also be moved in some measure by the muscles of the lips, which in many cases become assistants to the proper muscles of this organ.

*Muscles of the nose.*

330. The musculus pyramidalis or anterior on each side, is inserted by one extremity, in the synarthrosis of the Os Frontis and Ossa Nasi, where its fleshy fibres mix with those of the muscoli frontales and superciliares. It is very flat, and runs down on the side of the nose, increasing gradually in breadth, and terminating by an aponeurosis, which represents the basis of a pyramid, and is inserted in the moveable cartilage which forms the ala of the nares.

331. The oblique or lateral muscle is a thin, fleshy plane, lying on the side of the former, and in some subjects, appearing to form one broad muscle with it. This is probably the reason why the anterior muscle has been termed *triangularis*. The lateral muscle is fixed by its upper extremity to the apo-

phylis nasalis of the Os Maxillare, below its articulation with the Os Frontis, and sometimes a little lower than the middle of the inner edge of the orbit. From thence it runs toward the ala narium, and is inserted in the moveable cartilage, near the Os Maxillare, being covered laterally by a portion of the neighbouring muscle of the upper lip, with which, in some subjects, it appears to be confounded.

332. The transverse or inferior muscle, called also *myrtiformis*, is inserted by one end in the Os Maxillare, near the lower edge of the orbit, much about the place which answers to the extremity of the socket of the dens caninus on the same side. From thence it runs almost transversely upward, and is fixed in the lateral cartilages of the nose, over which, in some subjects, it seems to run to the alæ of the great cartilage, and to be inserted there.

333. The first two pairs of these muscles raise and dilate the alæ of the nares, when they act; and at the same time raise the upper lip, by reason of their connection with the muscles of that part. They likewise wrinkle the skin on the sides of the nose.

334. The membrana pituitaria is that which lines the whole internal nares, the cellular convolutions, the conchæ, the sides of the septum narium, and by an uninterrupted continuation, the inner surface of the sinus frontales and maxillares, and of the ductus lacrymales, palatini, and sphenoidales. It is likewise continued down from the nares to the pharynx, septum palati, &c. as we shall shew hereafter.

335. It is termed *pituitaria*, because, through the greatest part of its large extent, it serves to separate from the arterial blood a mucilaginous lymph, called *pituita* by the ancients, which in the natural state is pretty liquid; but it is subject to very great changes, becoming sometimes glutinous or stony, sometimes limpid, &c. neither is it separated in equal quantities through the whole membrane.

336. When we carefully examine this membrane, it appears to be of a different structure in different parts. Near the edge of the external nares it is very thin, appearing to be the skin and epidermis in a degenerated state. All the other parts of it in general are spongy and of different thicknesses. The thickest parts are those on the septum narium, on the whole lower  
portion



portion of the internal nares, and on the conchæ; and if we make a small hole in it at any of these places; and then blow through a pipe, we discover a very large cellular substance. In the sinuses it appears to be of a more slender texture.

337. On the side next the periosteum and perichondrium it is plentifully stored with small glands, the excretory ducts of which are very long near the septum narium, and their orifices very visible; and by applying a pipe to any of these orifices, the ducts may be blown up almost through their whole extent; but in order to this, the parts must first be very well cleaned and washed in lukewarm water.

338. In these places especially we likewise discover a very fine villous substance, when the parts are examined in clear water in the manner which I have described in another place, and which I have used in my public courses for above twenty years past. Riolan made use of this method in examining small foetuses.

339. The frontal, maxillary, and sphenoidal sinuses open into the internal nares, but in different manners. The frontal sinuses open from above downward, answering *Sinus.* to the infundibula of the Os Ethmoides, described in the history of the skeleton. The sphenoidales open forwards, opposite to the posterior orifices of the nares, and the maxillares open a little higher, between the two conchæ. Therefore the sinus frontales discharge themselves most readily when we stand or sit; and the sphenoidales, when the head is inclined forward.

340. The sinus maxillares cannot be emptied wholly or both at the same time in any one situation. Their opening, which in some subjects is single, in others double, &c. lies exactly between the two conchæ, about the middle of their depth; so that when the head is held straight, or inclined forward or backward, they can only be half emptied; but when we lie on one side, the sinus of the opposite side may be wholly emptied, the other remaining full.

341. It is proper here to observe the whole extent of the maxillary sinus. Below, there is but a very thin partition between it and the dentes molares, the roots of which do, in some subjects, perforate that septum. Above, there is only a very thin transparent lamina between the orbit and the sinus. Backward, above the tuberosity of the Os Maxillare, the sides  
of

of the sinus are very thin, especially at the place which lies before the root of the apophylis pterygoides, through which the inferior maxillary nerve sends down a ramus to the foramen palatinum posterius, commonly called *gustatorium*. Inward, or toward the conchæ narium, the bony part of the sinus is likewise very thin.

342. The lacrymal sacculus is an oblong membranous bag into which the serous fluid is discharged from the eye through the puncta lacrymalia, already described, and from which the same fluid passes to the lower part of the internal nares. It is situated in a bony groove and canal, formed partly by the apophysis nasalis of the Os Maxillare and Os Unguis, partly by the same Os Maxillare and lower part of the Os Unguis, and partly by this lower portion of the Os Unguis, and a small superior portion of the concha narium interior. This groove and canal are the bony lacrymal duct, about which I would advise beginners to consult what was said in the description of the skeleton.

343. I have an observation or two to add in this place concerning the situation of this bony duct. It runs down for a little way obliquely backward, toward the lower and lateral part of the internal nares on each side, where its lower extremity opens on one side of the sinus maxillaris under the inferior concha, nearly at the place from which a perpendicular line would fall in the interstice between the second and third dentes molares. The upper part of this duct is only an half canal or groove; the lower is a complete canal narrower than the former.

344. The sacculus lacrymalis may be divided into a superior or orbital portion, and an inferior or nasal portion. The orbital portion fills the whole bony groove, being situated immediately behind the middle tendon of the musculus orbicularis. About one fourth of its length is above this tendon, and the rest below. The nasal portion lies in the bony canal of the nose, being narrower and shorter than the former.

345. The orbital portion is disposed at its upper extremity, much in the manner of an intestinum cæcum, and at the lower extremity is continued with the portio nasalis. Towards the internal angle of the eye, behind the tendon of the

the

the orbicular muscle, it is perforated by a small short canal formed by the union of the lacrymal ducts.

346. The nasal portion having reached the lower part of the bony duct under the inferior concha, terminates in a small, flat, membranous bag, the bottom of which is perforated by a round opening, as I have always found it upon a careful examination, but which at first sight appears oblong.

347. I used to attribute this difference to the force which I was obliged to use in separating the concha inferior, in order to see this opening, which I have often found more backward than the middle of the bag at the extremity of this portion; and therefore when I would either see or shew this opening in its natural state, I do not separate the inferior concha, but cut it gently with a sharp knife, or with scissars. If a transverse line be drawn between the lower part of the nose and Os Malæ, and another line be drawn directly upward, opposite to the third dens molaris, or opposite to the second and third, these two lines will intersect each other nearly at the lower extremity of this sacculus.

348. I have sometimes found the upper extremity of this bag divided into an anterior and posterior part, by a kind of valvula connivens lying in the anterior portion, a little lower than the tendon of the musculus orbicularis. The small common canal of the two lacrymal ducts opens in the posterior portion, and consequently behind the valve.

349. The substance of this sacculus is something spongy or cellulous, and pretty thick, being strongly united by its convex side to the periosteum of the bony canal, which may be very distinctly shewn. This substance seems to be made up of two laminæ, joined together by a spongy membrane, the outermost of which is that which I have mentioned; the other appears to be glandulous, and is in some subjects loose and pliable, which I look upon as a disease.

350. The ductus incisarii, or naso-palatini of Steno, are two canals which go from the bottom of the internal nares cross the arch of the palate, and open behind the first or largest dentes incisarii.

*Ductus incisarii.*

Their two orifices may be distinctly seen in the skeleton at the lower part of the nasal fossæ, on the anterior and lateral sides of the cristæ maxillares; and we may likewise perceive their oblique passage through the maxillary bones, and lastly their



their inferior orifices in a small cavity or fossula, called *foramen palatinum anterius*. In fresh subjects they are not so apparent, especially in human subjects, for in sheep and oxen they are easily discoverable.

351. Santorini in his anatomical observations has described those of the human body in a very pretty manner, and has given us his method of discovering them, which is nearly the same with that which I have always made use of in my private courses, to shew at one view all the external parts which belong to the nose, as may be seen in the works published by my scholars, especially strangers. I say his method is nearly the same with mine, because instead of dividing the head into two equal lateral parts, I always direct the saw a little toward one side, to preserve the septum narium entire as well as that of the sinus frontales, sinus sphenoidales, and ductus incisorii; and on the other side, to preserve the conchæ and cells of the Os Ethmoides. For this purpose I use a very fine saw made of the spring of a watch.

352. By this method I shew on that side from which all the septa have been sawed off, the entire conchæ, their convex sides, the particular thickness of the membrana pituitaria on their lower edges, the orifice or orifices of the sinus maxillaris, the situation of the orifice of the sinus sphenoidalis, the communicating ducts that go between the sinus frontales and the ethmoidal cells, and interstices between the two conchæ, and the structure of the posterior openings of the nares. I can shew likewise at the same time the orifice of the Eustachian tube behind the posterior opening of the nares, and the communication of the nose with the mouth.

353. On the same side, I afterwards separate gradually with a very sharp knife, or with narrow sharp-pointed scissars, the superior or ethmoidal concha, without doing any violence to the neighbouring parts; and then I can shew on the parts covered by that concha, a little oblong or oval fossula which runs down obliquely from before backward; at the posterior and lower extremity of which, there is an orifice of about a quarter of an inch in diameter, which opens into the maxillary sinus; and another at the anterior or superior extremity, which opens into the frontal sinus.

354. Immediately behind this fossula there are two openings, one into the sinus frontales, the other into the ethmoidal

dal cellulæ of the Os Frontis. I shew likewise in the posterior part of the Os Ethmoides, at least two openings, by which the cells of that bone communicate with each other. All this is very different from what we see in the skeleton, or even when these parts are deprived of their membranes, &c. neither is the structure always the same in fresh subjects; for in some I have observed, a little before and above the opening of the maxillary sinus, two small grooves, which united in their passage to the frontal sinuses, the uppermost groove being a little contorted.

355. In the next place, I remove the concha inferior or maxillaris in the same manner and with the same precautions; and then I observe, at the distance of about a quarter of an inch from the anterior extremity of this concha, a small opening, the diameter of which is not above the twelfth part of an inch, and it is turned obliquely backward. It seems to be the extremity of a duct of the same diameter, but when it is slit with sharp pointed scissars, we discover a flat oval cavity, the diameter of which is a quarter of an inch in length, and lies in the same direction with the septum narium.

356. This oval cavity is the lower extremity of the sacculus lacrymalis, which consequently is only contracted between this inferior cavity and the orbitary portion. Within this narrow or contracted portion we see likewise the opening of a blind duct, which runs obliquely backward and upward for about a quarter of an inch; but I do not know precisely where it terminates or for what it is designed.

357. The arteries of all these parts come from the external carotid. Those of the external parts of the nose are chiefly branches and rami of the arteria maxillaris externa or angularis, and of the temporalis; and the arteries of the internal parts are branches and ramifications of the maxillaris interna. The veins are almost in the same manner, branches and ramifications of the external jugular, and they communicate with the orbitary sinus, and, by that means, with the sinuses of the dura mater, and with the internal jugulars.

*Arteries and veins.*

358. The principal nerves belonging to the nose are filaments of the nervi olfactorii, which run down through the holes of the transverse lamina of the Os Ethmoides, and are distributed to the common membrane

*Nerves.*

of the internal nares, especially to the villous portions thereof. The inner ramus of the orbital or ophthalmic sends a filament through the internal anterior orbital hole into the cranium, which comes out again in company with one of the filaments of the olfactory nerve through the ethmoidal lamina.

359. This internal ramus advances afterwards toward the Os Unguis, and is distributed partly to the sacculus lacrymalis, partly to the upper portion of the musculus pyramidalis, and of the integuments of the nose. The suborbital nerve, which is a branch of the maxillaris superior, having passed through the inferior orbital hole, sends filaments to the lateral external parts of the nose. Another ramus of the superior maxillary nerve goes to the posterior opening of the nares, being spent on the conchæ, and other internal parts of the nose.

360. The nose is the organ of smelling, by means of the villous portion of the internal membrane, to which *Ufes.* the olfactory nerves are chiefly distributed. It is likewise of use in respiration, and the mucilaginous fluid spread over the whole pituitary membrane, prevents the air from drying that membrane, and so rendering it incapable of being affected. The nose serves likewise to regulate and modify the voice, and to this the sinuses likewise contribute. The sacculus lacrymalis receives the serum from the eyes, and discharges it upon the palate, from whence the greatest part of it runs to the pharynx.

#### A R T. IV.

##### *The Ear.*

361. *The ear in general.* **E**Very one knows that the ears are two in number, that they are situated in the lateral parts of the head, and that they are the organs of hearing. Anatomists commonly divide or distinguish the ear into external and internal. By the external ear they mean all that lies without the external orifice of the meatus auditorius in the Os Temporis; and by the internal ear,



ear, all that lies within the cavities of that bone, and also the parts that bear any relation thereto.

362. The greatest part of the external ear consists of a large cartilage very artificially framed, which is the basis of all the other parts of which this portion of the ear is made up. The internal ear consists chiefly of several bony pieces, partly formed in the substance of the *Ossa Temporum*; and especially in that portion of it, called *apophysis petrosa*, and partly separated from, but contained in a particular cavity of that bone. All these bony pieces have been explained in the description of the skeleton, to which I must therefore refer, desiring those who have a mind to understand what I am now to say about the other parts of this organ, carefully to revise the explication there given.

363. The external ear taken all together resembles in some degree the shell of a muscle, with its broad end turned upward, the small end downward, the convex side next the head, and the concave side outward. Two portions are distinguished in the external ear taken all together, one large and solid, called in Latin *pinna*, which is the superior, and by much the greatest part; the other small and soft, called the *lobes*, which makes the lower part. We may likewise consider two sides in the outward ear, one turned obliquely forward, and irregularly concave, the other turned obliquely backward, and unequally convex; for all ears which have not been disordered by binding the head too tight in childhood, are naturally bent forward.

*The external ear.*

364. The foreside is divided into eminences and cavities. The eminences are four in number, called *helix*, *anthelix*, *tragus*, and *antitragus*. The helix is the large folded border or circumference of the great portion of the ear. The anthelix is the large oblong eminence or rising surrounded by the helix. The tragus is the small anterior protuberance below the anterior extremity of the helix, which in an advanced age is covered with hairs. The antitragus is the posterior tubercle, below the inferior extremity of the anthelix.

365. The cavities on the foreside are four in number, the hollow of the helix, the depression at the superior extremity of the anthelix, called *fossa navicularis*, the concha or great double cavity that lies under the rising termed *anthelix*, the

upper bottom of which is distinguished from the lower by a continuation of the helix in form of a transverse crista; and lastly, the meatus of the external ear situated at the lower part of the bottom of the concha.

366. The backside of the external ear shews only one considerable eminence which is a portion of the convex side of the concha, the other portion being hid by the adhesion of the ear to the Os Temporis. This adhesion hinders us likewise from seeing the hollow answering to the crista, by which the cavity of the concha is divided.

367. I have already said that the external ear consists chiefly of a cartilage, which is the basis of all the other parts. These other parts are ligaments, muscles, integuments, sebaceous and ceruminous glands, arteries, veins, and nerves; but I do not reckon among them a large gland, called by the Greeks *parotis*, because it lies very near the ear; the description of which must be referred to that of the salivary glands, of which it is the most considerable.

368. The cartilage of the outward ear is nearly of the same extent and figure with the large solid portion thereof, already mentioned; but it is not of the same thickness, being covered by integuments on both sides. In the lobe or soft lower portion of the ear, this cartilage is wanting. On the backside, it shews all the eminences and cavities on the fore side in an opposite situation with respect to each other, except the fold of the great circumference; and it consists only of one piece from that circumference all the way to the meatus externus, except at the two extremities of the folded part of the helix, where there are two small separate portions connected to the great cartilage only by the integuments.

369. The cartilaginous portion of the external meatus auditorius does not make a complete circle; but rather a short tube, in one side of which there is a break, and which terminates in an oblique border fixed to the edge of the bony canal by several small inequalities, as by a kind of ingrailing; and from this obliquity it is, that the cartilaginous border terminates downward in a kind of apex or point. The lateral break in this cartilage is between the upper and back part of its circumference; and on each side thereof the cartilaginous edges are rounded. There are likewise two or three other small incisions in this circumference, which, in regard

regard to the meatus, represent obliquely transverse fissures. The anterior fissure is in a manner quadrangular; neither are the intermediate parts always opposite to each other, for the uppermost is a little further from the Os Temporis than the posterior.

370. The external ear is fixed to the cranium, not only by the cartilaginous portion of the meatus already mentioned, but also by ligaments which are two in number, one anterior, the other posterior. The anterior ligament is fixed by one extremity to the root of the apophysis zygomatica of the Os Temporis, at the anterior and a little toward the superior part of the meatus osseus, close to the corner of the glenoid cavity; and by the other extremity, to the anterior and superior part of the cartilaginous meatus.

371. The posterior ligament is fixed by one end to the root of the mastoid apophysis, and by the other, to the posterior part of the convexity of the concha, so that it is opposite to the anterior ligament. There is likewise a kind of superior ligament, which seems to be only a continuation of the aponeurosis of the frontal and occipital muscles.

372. Of the muscles of the external ear, some go between the cartilages and the Os Temporis, others are confined to the cartilages alone. Both kinds vary in different subjects, and are sometimes so very thin, as to look more like ligaments than muscles. The muscles of the first kind are generally three in number, one superior, one posterior, and one anterior, and they are all very thin. The superior muscle is fixed in the convexity of the fossa navicularis, and of the superior portion of the concha; from whence it runs up to the squamous portion of the Os Temporis, expanding in a radiated manner, though not in the same degrees in all subjects, and is inserted principally in the ligamentary aponeurosis, which covers the posterior portion of the temporal muscle.

373. The anterior muscle is small, more or less inverted, and like an appendix to the superior. It is fixed by one extremity above the root of the zygomatic apophysis, and by the other, in the anterior part of the convexity of the concha.

374. The posterior muscle is almost transverse, and of a considerable breadth, being fixed by one end to the posterior part of the convexity of the concha, and by the other, in the



the root of the mastoide apophysis. It covers the posterior ligament; but the division of it into several portions mentioned by some authors, seems to be merely artificial, that is, owing to dissection.

375. The small muscles which are confined to the cartilages, are only small strata of fibres found on both sides of the cartilages. In many subjects they are of so pale a colour as not to look at all like muscular fibres. Of this number are those which Valsalva discovered in the different cavities on the backside of the cartilage, and those found by Santorini on the tragus, and along the convex part of the anterior portion of the helix.

376. The skin of the external ear is in general a continuation of that which covers the neighbouring parts of the temporal region. The skin on the foreside of the ear is accompanied by a very small quantity of cellular substance, and therefore we find all the eminences and cavities of that side distinctly marked upon it, as far as the bottom of the external meatus auditorius in what I have said of the skin, the epidermis is likewise comprehended.

377. The backside is covered by the skin continued from the foreside; but as the folds are there very close, it only passes over them, except that portion of the concha which surrounds the entry of the meatus auditorius, and which is joined to the Os Temporis by means of the cellular substance. The hollow of that common fold which lies between the anthelix and concha does not appear on the backside; for as it is filled with cellular substance, the skin passes over it.

378. The lobe of the ear, or that soft portion which lies under the tragus, antitragus, and meatus auditorius, is made up of nothing but skin and cellular substance. The meatus auditorius is partly bony and partly cartilaginous. The bony portion is the longest, and forms the bottom of the canal, as may be seen in the description of the skeleton. The cartilaginous portion is the shortest, and, in adults, forms the external opening or orifice of the canal, as has been already said.

379. These two portions joined endwise to each other, form a canal of about three quarters of an inch in length, of different wideness in its different parts, and a little contorted. It is lined on the inside by the skin and cellular membrane, through

through its whole length; and thus these integuments make up for the breaks in the cartilaginous portion, and form a kind of cutaneous tube in the other portion. The cellular membrane is confounded with the perichondrium and perosteum of the meatus.

380. The skin which covers both sides of the cartilage contains a great number of small glands, which continually discharge an oily, whitish humour collected chiefly near the adhesions of the ear to the head, and under the fold of the helix; and these glands are of the sebaceous kind. The skin which lines the meatus auditorius contains another kind of glands, of a yellowish colour, and which may be plainly seen on the convex side of the cutaneous tube already mentioned.

381. These glands are disposed in such a manner as to leave reticular spaces between them, and they penetrate a little way into the substance of the skin. They are called *glandulae ceruminosae*, because they discharge that matter which is named *cerumen*, or the *wax of the ear*. The inner surface of the cutaneous tube is full of fine hairs, between which lie the orifices of the ceruminous glands. The first place in which we meet with these glands is on that part of the convex side of the cutaneous tube, which supplies the breaks of the cartilaginous meatus.

382. The arteries of the external ear come anteriorly from the arteria temporalis, and posteriorly from the occipitalis, which is a branch of the external carotid. It is proper to observe here, that the occipital artery communicates with the vertebralis, and thereby with the internal carotid. The veins are rami of the jugularis externa; and the occipital vein, one of these rami communicates, not only with the vena vertebralis, but with the neighbouring lateral sinus of the dura mater.

383. The portio dura of the auditory nerve having passed out of the cranium through the foramen stylo-mastoideum, in the manner that shall be afterwards described, gives off a ramus which runs up behind the ear, to the backside of which it sends several filaments; and the trunk of this ramus sends likewise filaments to the meatus and foreside of the ear. The second vertebral pair sends also a ramus to the ear, the ramifications of which communicate with those of the other ramus from the portio dura.

384. I must here begin by repeating the advice which I gave above, to read over and retain what has been said about the bony part of the organ of hearing in the description of the skeleton, from N<sup>o</sup> 260. to 267. and from N<sup>o</sup> 392. to 444. It would be too long to repeat all these particulars in this place, but it is absolutely necessary to have a complete idea of all the bony parts, if we would understand the description of the other parts of the ear, to which I am now to proceed.

385. These parts are chiefly the membrana tympani, the periostrum of the barrel, officula auditus, labyrinth, and of all its cavities, the membrana mastoidea interna, the muscles of the officula, the parts which complete the formation of the Eustachian tube, the arteries, veins, and nerves. I find myself, however, under a necessity of beginning by the tuba Eustachiana, for two reasons: first, because the bony parts of that tube are but of very small use for the knowledge of its whole structure and composition; and secondly, because we are obliged to mention it in describing the muscles.

386. I spoke of the Eustachian tube in the description of the skeleton, by the name of *ductus auris palatinus*; and I took notice that in France it goes generally by the name of *aqueduc*, which, however must not be confounded with the *aqueductus Falloppii*. In N<sup>o</sup> 402. of sect. 1. I observed, that it is a canal or duct which goes from the tympanum to the posterior openings of the nares, or nasal fossæ, and toward the arch of the palate; that it is dug in the apophysis petrosa, along the carotid canal, and that it is lengthened out by the spinal apophysis of the Os Sphenoidale.

387. In its natural state, this duct reaches from the cavity of the barrel, to the root or superior part of the internal ala of the apophysis pterygoïdes; and through this whole course it is made up of two portions, one entirely bony, and the other partly bony, partly cartilaginous, and partly membranous. That beginners may not here be misled, it is very necessary to remember the advice which I gave in the description of the skeleton, N<sup>o</sup> 186. &c. that in examining the lower parts of the basis cranii, the skull ought to be raised up, and viewed from below upwards, &c.

388. The bony portion lies through its whole length immediately above the fissure of the glenoid or articular cavity of



of the *Os Temporis*, and terminates at the meeting of the spinal apophysis of the *Os Sphenoidale*, with the apophysis petrosa of the *Os Temporis*, that is, between that spinal apophysis, and the inferior orifice of the carotid canal.

389. The other or mixed portion reaches in the same direction from this place, to the internal ala of the apophysis pterygoïdes, or to the posterior and outer edge of the nares. But to form a more exact idea of it, it will be proper to consider it as divided into four parts, two superior, and two inferior.

390. The two upper parts or quarters are bony; and of these, the innermost is formed by the side of the apophysis petrosa, the outermost, by the side of the apophysis spinalis of the *Os Sphenoides*, so that the upper half of this portion of the tube is bony. Of the two inferior parts, the internal is cartilaginous, and the external membranous, so that the lower half of this portion of the tube is partly cartilaginous next the *Os Sphenoidale*, and partly membranous next the apophysis petrosa.

391. The Eustachian tube thus formed, is very narrow in the bony part next the ear. The other portion grows gradually wider, especially near the posterior nares, where the inner cartilaginous side terminates by a prominent edge, and the outer side joins that of the neighbouring nostril. The cavity of the tube is lined by a membrane like that of the internal nares of which it appears to be a continuation; and on the prominent edge, this membrane is considerably increased in thickness, representing a kind of half pad.

392. The situation of the two tubes is oblique, their posterior extremities at the ears being at a greater distance than the anterior at the nares, and the convex sides of the prominent edges are turned toward each other. The openings of the tubes are oval at this place, as is likewise their whole cavity, especially that of the mixed portion.

393. The *membrana tympani* is a thin, transparent, flattish pellicle, the edge of which is round, and strongly fixed in the orbicular groove which divides the bony meatus of the external ear from the tympanum or barrel. This membrane is very much stretched or very tense, and yet not perfectly flat; for on the side next the meatus externus it has a small hollowness which is pointed on the middle, and on the side next

the tympanum it is gently convex, and also pointed in the middle.

394. This membrane is sutated obliquely, the upper part of its circumference being turned outward, and the lower part inward, suitably to the direction of the bony groove already mentioned. It is made up of several very fine laminae, closely united together. The external lamina is in some measure a production of the skin and cuticula of the external meatus; for they may be pulled at the same time like the finger of a glove. The internal lamina is a continuation of the periosteum of the tympanum, and when the membrane has been first macerated in water, each of these laminae may be subdivided into several others, which I have sometimes made to amount, in all, to six. In very young children this membrane is covered on the outside by a thick mucilaginous web.

395. The depression in the middle of the membrana tympani is caused by the adhesion of the little bone called *malleus*, the handle of which is closely joined to the inside of the membrane from the upper part of the circumference all the way to the centre to which the end of the handle is fixed. This handle seems to lie in a very fine membranous duplicature, by means of which it is tied to the membrana tympani, and which serves it for a periosteum.

396. The periosteum of the tympanum or barrel of the ear produces that of the small bones, and it may be made visible by means of anatomical injections, which discover capillary vessels very distinctly ramified on the surface of the ossicula, as has been shewn in my private courses. It is likewise continued over the two fenestrae, and enters the Eustachian tube, where it is lost in the inner membrane of that duct.

397. The cellulae mastoidæ are very irregular cavities in the substance of the mastoid apophysis, which communicate with each other, and have a common opening towards the inside, and a little above the posterior edge of the orbicular groove. These cells are lined by a fine membrane, which is partly a continuation of the periosteum of the tympanum, and partly seems to be of a glandular structure like a kind of the membrana pituitaria. The mastoid opening is opposite to the small opening of the Eustachian tube, but a little higher.

398. The

398. The ligaments of the ossicula come next in order; to understand which, I suppose the reader acquainted with what I said concerning these small bones in the description of the skeleton, N<sup>o</sup> 407. &c. The incus is tied by a strong, short ligament fixed in the point of the short leg, to the edge of the mastoid opening. Between the incus and malleus we find a small, thin cartilage. The malleus is connected through the whole length of its handle to the inside of the membrana tympani, in the manner already said; I need only add here, that by help of a microscope we discover round the point of the handle, in the substance of the membrane, a small orbicular plane of a whitish colour, a little inclined to red.

399. The malleus has three muscles, one external, one anterior, and one internal; and the stapes has one muscle. The external or superior muscle of the malleus, attributed to Casserius, and mentioned by Fabricius ab Aquapendente, is a thin fasciculus of fleshy fibres lying along the upper part of the bony meatus auditorius, between the periosteum and the other integuments. The outer part of it is pretty broad, and it contracts by degrees as it advances towards the upper part or break of the orbicular groove of the tympanum, into which it enters by a small tendon, above the membrana tympani, and is inserted in the neck of the malleus, near the small eminence or short apophysis of the handle. This muscle is sometimes so pale as hardly to be distinguished.

400. The anterior muscle of the malleus, called by M. Duvernay the *external*, is fleshy, long, and thin. It runs along the outside of the Eustachian tube, to which it adheres very closely through its whole length. Its anterior extremity is fixed in that side of the tube just before the sphenoidal spine; and the posterior extremity ends in a long thin tendon, which runs in the articular or glenoid fissure of the Os Temporale, through a small oblique notch, in which fissure it enters the tympanum, and is inserted in the long thin apophysis of the malleus. It is partly accompanied by a nerve, which forms what is called the chorda tympani, as we shall see hereafter.

401. The internal muscle of the malleus is very fleshy



and distinct. It lies along the inside of the Eustachian tube partly on the cartilaginous, and partly on the bony portion; being fixed by one extremity in the apophysis petrosa. Afterwards it runs along the cavity of the bony half canal of the tympanum, within which cavity it is invested by a portion of a membranous or ligamentary vagina, which being fixed to the edges of the half canal, forms an entire tube therewith, and this vagina must be cut open before we can see the muscle.

402. At the extremity of this bony half canal, where we observe the cavity shaped like the mouth of a spoon, mentioned in the description of the skeleton, N<sup>o</sup> 399. this muscle ends in a tendon, which is bent round the transverse bony or ligamentary ridge in the last-named cavity, as over a pulley, and is inserted in the neck of the malleus above the small apophysis, advancing likewise as far as the handle. The extremities of the anterior and internal muscles sometimes meet, and there they cover the mixed portion of the Eustachian tube.

403. The muscle of the stapes is short and thick, and lies concealed within the small bony pyramid at the bottom of the tympanum. The cavity which it fills, touches very nearly the bony canal of the portio dura of the auditory nerve; and it terminates in a small tendon which goes out of the cavity through the small hole in the apex of the pyramid. As it goes through the hole it turns forward, and is inserted in the neck of the stapes on the side of the longest and most crooked leg of that bone,

404. The three parts of the labyrinth, that is, the vestibulum, semicircular canals, and cochlea, are lined by a fine periosteum, which is continued over all the sides of their cavities, and shuts the two fenestræ of the tympanum.

405. In all the subjects which I ever examined, I have found the semicircular canals simply lined by a periosteum adhering to their inner surfaces, without any particular membranous bands. The two half-canals of the cochlea are lined in this manner; the periosteum of the two sides of the bony spiral lamina advances beyond the edge of that lamina, and forms a membranous duplicature, which extending to the opposite side completes the spiral septum.

406. This

406. This septum separates the two half canals from the basis to the apex, but there it leaves a small opening, by which the small extremities of the half-canal communicate with each other. The large extremity of the external half-canal ends by an oblique turn in the fenestra rotunda, which is shut by a continuation of the periostrum of that canal. The large extremity of the other half-canal opens into the vestibulum; and these two extremities are entirely separated by a continuation of the periostrum.

407. All the periostrum of the internal ear, especially that of the ossicula and tympanum, is in children no more than a mucilage; and in them likewise the membrana tympani is thick, opaque, and covered with a whitish, slimy matter.

408. Through the whole extent of the periostrum of the internal ear, especially on that of the ossicula, semicircular canals, and half-canal of the cochlea, we discover a vast number of blood vessels, not only by anatomical injections, but in inflammations, and even without the help of a microscope; for I have often shewn them to the naked eye in the semicircular canals and half-canal of the cochlea. The arteries come partly from the internal carotid, and partly from the arteria basilaris, which is a continuation of the vertebralis, the small capillary ramifications of which may be observed to accompany the auditory nerve through the internal foramen auditorium.

409. The portio mollis of the auditory nerve ends, by its trunk, at the great fossula of the internal auditory hole; from whence the filaments pass through several small holes in the basis of the cochlea, partly to the periostrum of the semicircular canals, and partly to the internal periostrum of the half-canal of the cochlea.

410. The portio dura, which I name *nervus sympatheticus minor*, runs first of all into the small fossula of the foramen auditorium internum, then passes through the whole bony duct, called *aquæductus Falloppii*, and comes out again through the stylo mastoide hole of the Os Temporis. In this course it communicates with the dura mater on the upper or anterior side of the apophysis petrosa, at the place where the bony duct is interrupted, as was mentioned in the description of the skeleton, N<sup>o</sup> 264. 443.

411. Having reached behind the small pyramid in the bottom of the tympanum, this nerve sends a small filament to the muscle of the stapes; and a little before it goes out by the stylo-mastoide hole, it gives off another more considerable filament, which enters the tympanum from behind forward, passes between the long leg of the incus and handle of the malleus, and afterwards runs cross the whole breadth of the tympanum a little obliquely, and goes out at the same place at which the tendon of the anterior muscle of the malleus enters.

412. This small nerve is generally called *chorda tympani*, because in its passage through the tympanum it has been compared to the chord of a drum. Having left the cavity of the internal ear, it advances toward one side of the basis of the tongue, where having joined the small nervus lingualis, it is considered as a kind of recurrent; but the remaining part of its course must be referred to the description of the tongue.

413. The portio dura of the auditory nerve having passed through the foramen stylo-mastoidæum, is distributed in the manner already mentioned in the description of the nerves; and we ought very carefully to observe its different communications with the branches and rami of the nerves of the fifth pair, with the sympathicus medius or eighth pair, with the second pair of cervical nerves, and with the nervi sub-occipitales or tenth pair of the medulla oblongata, &c.

414. The ear is the organ of which we can most distinctly unfold the structure, and demonstrate the greatest number of parts, that is, of small machines of which it is made up. We know likewise in general that it is the organ of hearing; but when we endeavour to discover the uses of each of these parts, that is, how each contributes to the great design of the whole, after having thoroughly examined them, we must be obliged to own that the greatest part of what the most able philosophers have said upon this subject, is without any real foundation.

415. It is certain that the cavity of the external ear collects sounds or noise, and concentrates it towards the bottom of the concha, all the way to the external meatus auditorius. This we learn from experience, by enlarging this cavity with the hand. It may likewise be affirmed with certainty, that



in proportion as the membrana tympani is more or less stretched, sounds become more or less sensible. This experience teaches us; for when this membrane is wetted by any liquor, our hearing is imperfect, but is restored again when the membrane is dry. By the muscles of the ossicula, we can demonstrate that this membrane is capable of being stretched and relaxed, as occasion requires; but the prosecution of this curious subject must be referred to another treatise.

## A R T. V.

### *The Mouth.*

416. **T**HE word *mou**th*** may have two significations; for, first, it means the transverse slit between the nose and chin, formed by the lips; and secondly, it expresses the internal cavity, of which this transverse slit is the external opening. For this reason the mouth may be distinguished into external and internal, and the parts of which it consists may likewise come under the same two general heads. The bony parts are the *Ossa Maxillaria*, *Ossa Palati*, maxilla inferior, and the teeth: to these we may add the *Os Hyoides*, and the upper vertebræ of the neck.

*Introduction.*

417. The external parts of the mouth are the two lips, one upper, the other under, the borders or red parts of the lips, the corners or commissures of the lips, the fossula of the upper lip, the basis of the under lip, the chin, the basis of the chin, the skin, beard, and even the cheeks, as being the lateral parts of the mouth in general, and of the lips in particular.

418. The internal parts of the mouth are the gums, palate, septum palati, uvula, amygdalæ, the tongue, the membrane which lines the whole cavity of the mouth, the salival ducts and glands, and the bottom of the mouth. We might likewise reckon among the internal parts of the mouth, all the muscles that have any relation to it, as those of the lips, of the tongue, of the uvula, of the septum palati, &c. and

to

to these might be added the muscles of the lower jaw, and of the Os Hyoides, which have been already described.

419. In the compendious view of the parts of the human body, I made a general enumeration of all those that belong to the neck, of which there is a very considerable number, but the greatest part of them has been already described among the bones, muscles, arteries, veins, and nerves, and of those that remain, very few belong to the description of the thorax.

420. The parts of the neck still undescribed are only the larynx, pharynx, glandulæ thyroideæ, and the musculus cutaneus, which really belongs to the head; and therefore instead of making a particular section for so small a number of parts, I chose to bring them in, under the description of the head, especially since the larynx and pharynx have so near a relation to the internal parts of the mouth, that I find myself under a necessity of describing them, before I proceed to the mouth in particular.

### § 1. *The larynx.*

421. The larynx forms the protuberance in the upper and anterior part of the neck, called commonly *pomum Adami*. Anatomists term it the *head of the trachea arteria*, which I explained particularly in the description of the thorax, N<sup>o</sup> 127. &c. and it is larger and more prominent in men than in women.

422. It is chiefly made up of five cartilages, the names of which are these: cartilago thyroides, which is the anterior and largest; cricoides, the inferior, and basis of the rest; two arytenoides, the posterior and smallest; and the epiglottis, which is above all the rest. These cartilages are connected together by ligaments, and they have likewise muscles, glands, membranes, &c. belonging to them.

423. The cartilago thyroideæ is large and broad, and folded in such a manner as to have a longitudinal convexity on the foreside, and two lateral portions which may be termed *ala*. The upper part of its anterior middle portion is formed into an angular notch; the upper edge of each *ala* makes an arch, and

*Cartilago thyroides.*

and together with the middle notch, these two edges resemble the upper part of an ace of hearts in playing cards.

424. The lower edge of each ala is more even, and the posterior edges of both are very smooth, being lengthened out both above and below by apophyses, which I name the *cornua of the thyroide cartilage*. The superior apophyses are longer than the inferior, and the extremities of all the four are rounded like small heads, which in the inferior apophyses have a shining surface on the inside, resembling an articular eminence.

425. On the outside of each ala near the edge, is a prominent oblique line which runs from behind forward. The upper extremity of this line is near the superior apophysis or cornu, and both that and the lower extremity end in a small tuberosity, the lowest being often the most considerable. These tuberosities serve for the insertion of muscles and ligaments. The inside of the alæ and the convex side of the anterior portion are very uniform; and this cartilage ossifies gradually in old age.

426. The cricoide cartilage resembles a kind of thick, irregular ring, very broad on one side and narrow on the other; or it may be compared to a small portion of a thick tube, cut horizontally at one end, and very obliquely at the other. I distinguish it into a basis and top, into an anterior, posterior, and two lateral sides. The basis is almost horizontal, when we stand, and to this the *aspera arteria* is connected, so that the cricoides may be looked upon as the upper extremity of the trachea.

*Cartilago cricoides.*

427. The posterior portion of the cricoides is larger than the rest, and its posterior or convex side is divided by a longitudinal eminence, or prominent line into two distinct surfaces, for the insertion of muscles. The top is gently sloped above this prominent line, and terminates on each side by a kind of obtuse angle, formed between it and the oblique edge of each lateral portion of this cartilage. At the upper part of each of these angles, there is a very smooth articular surface, gently convex.

428. The whole posterior side is distinguished into two lateral portions by two prominent lines, each of which runs down almost in a straight direction from the articular surface



at the top, a little below the middle of this side, where terminates in another articular line a little concave; and near these four articular surfaces there are small tubercles. The two superior surfaces are for the articulation of the cartilagine arytoidæ, as we shall see presently; and the two inferior, for the articulation of the inferior cornua or appendices of the cartilago thyroides.

429. The cartilagine arytoidæ are two small, equal, similar cartilages, which joined together, resemble the spout of an ewer, and they are situated on the top of the cricoides. In each, we may consider the basis, cornua, two sides, one posterior and concave, the other anterior and convex, and two edges, one internal, the other external, which is very oblique. The bases are broad and thick, and have each a concave articular surface, by which they are joined to the cricoides.

430. The cornua are bent backward, and a little toward each other. In some subjects they are very loose, appearing like true appendices, and easily separable from the rest, as I demonstrated in my private courses about eight years ago. Between their inner edges they form a kind of fissure, and their outer oblique edges terminate each by a thick prominent angle.

431. The epiglottis is an elastic cartilage, nearly of the figure of a purslane leaf, narrow and thick at the lower part, thin and slightly rounded at the upper part, gently convex on the foreside, and concave on the backside. It is situated above the anterior or convex portion of the cartilago thyroides; and its lower extremity is tied by a short, pretty broad, and very strong ligament to the middle notch in the upper edge of that cartilage. It is perforated by a great number of holes, something like those in the leaves of the hypericum or St. John's-wort, which are hid by the membranes that cover its two sides.

432. The cartilago thyroides is connected to the cricoides by several short strong ligaments, round the articulations of the two inferior cornua with the lateral articular surfaces of the cricoides. The apices of the superior cornua are fixed to the posterior extremities of the great cornua of the Os Hyoides, by slender, round ligaments, about a quarter of an inch in length.

433. In

433. In the middle of each of these ligaments, we often meet with a small cartilage of an oval figure, and much thicker than the ligaments. The thyroïdes is likewise connected to the Os Hyoides by a short, broad, strong ligament, one end of which is inserted in the superior notch of the cartilage, and the other in the lower edge of the basis of the bone. It has also two ligaments at the middle of the concave side which belong to the arytenoidææ.

434. The cricoides is tied to the lower part of the thyroïdes by a strong ligament; and by the ligaments already mentioned to the inferior cornua of that cartilage. Its basis is fixed to the first cartilaginous ring of the trachea arteria, by a ligament exactly like those by which the other rings are connected together; and the membranous or posterior portion of the trachea is likewise fixed to the posterior part of the basis of the cricoides.

435. The cartilagineæ arytenoidææ are connected to the cricoides by ligaments, which surround their articulations with the top of that cartilage. Anteriorly *Glottis.* the basis of each arytenoides is fixed to one end of a ligamentary cord, which by its other end is inserted about the middle of the concave side of the anterior portion of the thyroïdes. At their insertions in the thyroïdes, these two ligaments touch each other, but a small space is left between them, where they are fixed in the two arytenoides; and they seem likewise to have a small adhesion to the top of the cricoides. This is what is called *the glottis.*

436. Under these two ligamentary cords there are two others which run likewise from behind forward. The interstice between the superior and inferior cords on each side form a transverse fissure, which is the opening of a small membranous bag, the bottom of which is turned outward, that is, toward the ala of the thyroïdes. These two sacculi are the ventricles mentioned by the ancients, and restored by M. Morgagni, who has given an excellent description of them. They are chiefly formed by a continuation of the internal membrane of the larynx, and the inner surface of their bottom appears sometimes to be glandulous.

437. On the anterior surface of the arytenoide cartilages, there is a small depression between the basis and the convex upper part. This depression is filled by a glandulous body,

which not only covers the anterior surface of each arytenoides, but is likewise extended forward from the basis over the posterior extremity of the neighbouring ligamentary cord. They are larger and more sensible in some subjects than in others; and they are covered by the membrane which lines the neighbouring parts. These glands were discovered by M. Morgagni.

438. I have already described the ligaments which connect the epiglottis to the notch of the thyroides, and to the basis of the Os Hyoides. These two ligaments, and a third which ties the basis of the Os Hyoides to the notch of the thyroides, form a triangular space filled with a cellular or fatty substance, and with small glands.

439. The epiglottis has likewise two lateral ligaments, by which it is connected to the arytenoides, all the way to their points or cornua. It has also a membranous ligament, which running along the middle of its anterior or concave side, ties it to the root or basis of the tongue. This ligament is only a duplicature of the membrane which covers the epiglottis, continued to the neighbouring parts. Lastly, there are two lateral membranous ligaments belonging to it, fixed near the glandulous bodies called *amygdalæ*.

440. The epiglottis is not only perforated by the regular holes already mentioned, but has likewise a great number of small irregular scissures and breaks, which are so many different lacunæ situated between its two membranes, and filled with small glands, the excretory orifices of which are chiefly on the backside of this cartilage.

441. The larynx gives insertion to a great number of muscles, which may be divided into common, proper, and collateral. The common muscles, according to the general acceptation of that term, are all those that move the whole body of the larynx, one extremity of them being inserted in other parts; and these are reckoned to be four in number; two for each side, viz. sterno-thyroidæi, thyro-hyoidæi, or hyo-thyroidæi.

442. The proper muscles are those inserted wholly in the larynx, and which move the cartilages separately. These have been divided in various manners, but may be all reduced to the following pairs. Crico-thyro-hyoidæi Crico-arytenoidæi laterales. Crico-arytenoidæi posteriores. Thyro-arytenoidæi.



arytenoidæi. arytenoidæi. Thyro-epiglottici. Aryteno-epiglottici. Thyro-epiglottici.

443. By the collateral muscles, I understand those which are inserted by one portion in the larynx, without appearing to contribute any thing to the motions of it. Of this kind are the thyro-pharyngæi crico-pharyngæi, &c. of which hereafter.

444. The larynx may likewise be moved by muscles, which are not immediately inserted in it, but altogether in other parts. Such are the mylo-hyoidæi, genio hyoidæi, stylo-hyoidæi, omo-hyoidæi, sterno-hyoidæi, and especially the digastrici of the lower jaw, by reason of their particular adhesion to the Os Hyoides. It is likewise probable that those muscles of the pharynx which are inserted in the basis cranii, may in certain circumstances move the larynx in some small degree.

445. The sterno-thyroidæi are two long, flat, narrow, thin muscles, like ribands, broader above than below, and situated along that part of the neck which lies between the thyroide cartilage and the sternum. They are covered by the sterno-hyoidæi, and they cover the thyroide glands, passing immediately before them. *Sterno-thyroidæi.*

446. Each muscle is fixed by its lower extremity, partly in the superior portion of the inner or backside of the sternum, partly in the ligament and neighbouring portion of the clavícula, and partly in the cartilaginous portion of the first rib. Sometimes it runs a great way down on the first bone of the sternum, and crosses the muscle on the other side. From thence it runs up on the aspera arteria, close by its fellow, passes before the thyroide glands, over the cricoide cartilage, and is inserted by its upper extremity, in the lower part of the lateral side of the thyroide cartilage, and partly along that whole side. I have found this muscle double, one distinct portion of it being inserted in the basis, and the other laterally.

447. The thyro-hyoidæi, or hyo-thyroidæi are two flat, thin muscles, lying close by each other, between and above the former. Each of them is inserted by its upper extremity, partly in the basis, and partly in the neighbouring part of the great cornu of the Os *Thyro-hyoidæi.*

Os Hyoides; and by its lower extremity, in the lower part of the lateral side of the thyroide cartilage, immediately above the superior extremity of the sterno-thyroidæus; and both this superior extremity of the last-named muscle, and the lower extremity of the thyro-hyoidæus are, at their place of union, confounded a little with the thyropharynx inferior, of which hereafter.

448. The crico-thyroidæi, are two small muscles, situated obliquely at the lower part of the thyroide cartilage. They are inserted by their lower extremities in the anterior portion of the cricoide cartilage, near each other, and by their superior extremities, laterally in the lower edge of the thyroide cartilage at a distance from each other. By this oblique situation, they represent a Roman V.

449. Each of these small muscles is in a manner double, its upper extremity inserted in the thyroide cartilage, being in some subjects very broad, and divided into two portions, one anterior, the other more lateral and more oblique. They may likewise be easily separated into two distinct muscles, whereof one may be called *crico-thyroidæus anterior sive internus*; the other *lateralis sive externus*.

450 The two muscoli crico-arytenoidæi posteriores are situated posteriorly at the large or back portion of the cricoides, filling almost the two longitudinal surfaces of that portion, and distinguished by the prominent line between these two surfaces, already mentioned. Each of them runs up obliquely, and is inserted by its upper extremity, in the posterior part of the basis of the arytenoide cartilage of the same side, near the angle of that basis.

451. The two crico arytenoidæi laterales are small, and situated more laterally than the former. Each muscle is fixed by one end to the side of the broad part of the cricoides, and by the other to the lower part of the side of the neighbouring arytenoides.

452. The two thyro-arytenoidæi are very broad, each muscle being situated laterally between the thyroide, and cricoides; It is fixed by a broad insertion in the inside of the ala of the thyroide cartilage; and the fibres contracting from thence, run from before backward, and from below upward, towards the neighbouring arytenoide

noide cartilage, in which they are inserted, from the glottis to the angle of the basis. In some subjects, these muscles cover almost both sides of the glottis.

453. The arytenoidæi are small muscles lying on the posterior concave sides of the arytenoide cartilages. Dr. James Douglas, in the first edition of his treatise *Arytenoidæi.* of the muscles, divided them into two kinds, one of which he called *arytenoidæi majores*, the other *arytenoidæi minores*; and it must be owned that there is some variety in different subjects. I shall here confine myself to what I have most frequently and most distinctly observed, and that is, that there are two crucial arytenoidæi and one transverse.

454. The crucial muscles run each obliquely from the basis of one arytenoide cartilage, to the middle and upper part of the other, the left muscle covering the right, as is observed by M. Morgagni in his first *Adversaria*.

455. I look upon these muscles as superior crico-arytenoidæi, because I have always found them partly inserted in the upper neighbouring portion of the cricoides. The arytenoidæus transversalis is inserted more or less directly by both extremities, in the two arytenoide cartilages; and this I look upon as the true musculus arytenoidæus.

456. The two thyro-epiglottici cross the thyro-arytenoidæi, being inserted in the inner lateral part of the thyroides, and laterally on the epiglottis. *Thyro-epiglottici.*

457. The aryteno-epiglottici are small fleshy fasciculi, each of which is fixed by one extremity in the head of one of the arytenoide cartilages, and by the other in the nearest edge of the epiglottis. *Aryteno-epiglottici.*

458. I never had an opportunity of examining the hyo-epiglottici in very muscular subjects, and therefore I am not sure that the fibres which go from the convex side of the basis of the Os Hyoides, to the convex side of the epiglottis, are really fleshy. *Hyo-epiglottici.*

459. The larynx serves particularly to admit and let out the matter of respiration; and the solidity of the pieces of which it is composed, hinders not only external objects, but also any hard thing which we swallow, from disordering this passage. The glottis being a narrow slit, modifies the air which we breathe, and as it is very easily dilated and contracted, it forms the different tones of the voice, chiefly by *Uses*



by means of the different muscles inserted in the cartilagineæ arytenoidææ, to which the other muscles of the larynx, both proper and common, are assistants.

460. The whole larynx is likewise of use in deglutition, as has been already observed, by means of its connection with the Os Hyoides, to which the digastric muscles of the lower jaw adhere; which muscles raise the larynx together with the Os Hyoides every time we swallow. I have already said something on this subject in the description of the muscles, N<sup>o</sup> 1130. 1131. 1132. and shall further explain it after the description of the pharynx and tongue.

461. The facility of varying and changing the tone of the voice, depends on the flexibility of the cartilages of the larynx, and decreases in proportion as we advance in age; because these cartilages gradually harden and ossify, though not equally soon in all persons; and this change happens not only in the cartilago thyroïdes, but also to the cricoides and arytenoides.

462. The musculi sterno-thyroidæi serve in general to pull down the thyroïde cartilage, and the whole larynx along with it. They may likewise assist the sterno-hyoidæi in its actions, explained sect. 3. N<sup>o</sup> 1149. and compress the thyroïde gland, of which hereafter. The thyro-hyoidæi may, as occasion requires, either draw up the larynx toward the Os Hyoides, or draw that bone downward toward the cartilago thyroïdes.

463. It is difficult to determine the use of the crico-thyroidæi from their situation. They may either pull the cricoides obliquely backward, or the thyroïdes obliquely forward; and by this action the inferior cornua of the thyroïdes, and small articular surfaces of the cricoides, must slide upon each other.

464. Both the lateral and posterior crico-arytenoidæi, may separate the arytenoïde cartilages, and thereby open or dilate the glottis, but they do not both perform this action in the same manner. The lateral muscles separate these cartilages obliquely forward, and at the same time loosen or relax the sides of the glottis; but the posterior muscles separate them obliquely backward, and at the same time stretch or extend the sides of the glottis; and when both muscles act equally, they separate the cartilages directly.

465. The thyro-arytenoidæi acting together, draw both  
the

the arytenoide cartilages forward, and consequently loosen the glottis, and render it capable of the smallest quaverings of the voice. They may likewise probably compress the lateral sinuses or ventricles of the larynx, and also the arytenoide glands.

466. The arytenoidæi bring the arytenoide cartilages close together, and press them against each other; and when the cartilages are in this situation, they may at the same time be inclined either forward by the thyro-arytenoidæi, or backward by the crico-arytenoidæi posteriores. By this means the glottis, when shut, may be either relaxed or tense, and in this last case it is entirely shut, as when we hold in our breath in straining; but of this more in another place.

467. The general use of the epiglottis is to cover the glottis like a pent-house, and thereby hinder any thing from falling into it when we eat or drink; and for this purpose it is depressed in the manner that shall be shewn hereafter. It serves likewise to hinder the air which we inspire, from rushing directly upon the glottis, but by splitting it, as it were, obliges it to enter by the sides, or in an oblique course. The muscles of the epiglottis do not appear to be absolutely necessary for that cartilage; for, in deglutition, it may be sufficiently depressed by the basis of the tongue; and it may raise itself again by its own elasticity. The thyro-epiglottici and aryteno-epiglottici may serve to shut any lateral openings that might remain when the epiglottis is depressed by the basis of the tongue; and the hyo-epiglottici may pull it a little forward in strong respirations, as in sighing, yawning, &c.

## § 2. *The pharynx.*

468. The pharynx is a muscular and glandular bag, the outer surface of which is closely joined to the inner surface of all that space which is at the bottom of the mouth, behind the posterior nares, uvula, and larynx, and which reaches from the great or anterior apophysis of the Os Occipitis all the way to the œsophagus, which is the continuation of the pharynx. This space is bounded posteriorly by the muscles which cover the bodies of the first vertebræ of the neck, and laterally by the superior portions of both the internal jugular veins, and of both the internal carotid arteries, by the spinal

apophyses of the Os Sphenoides, by the extremities of the apophyses petrosæ, by the Os Sphenoides, immediately above the internal alæ of the apophyses pterygoides, and by the neighbouring portion of both pterygoide muscles.

469. From these limits and adhesions of the pharynx we may pretty nearly determine its figure. It may be compared to the wide part of a covered funnel of which the œsophagus is the narrow part or tube; or it may be called the *broad end of the œsophagus*, that and the pharynx taken together being compared to a trumpet. The pharynx may be divided into three parts, one superior, which is the arch of the pharynx, one middle, which is the body or great cavity, and one inferior, which is the bottom, narrow portion, or sphincter. We are likewise to observe in it three openings, that of the arch, toward the nares, that of the body, toward the mouth, and that of the bottom, toward the œsophagus.

470. The arch is the broadest part of the pharynx, and ends on each side in an angle or point, toward the jugular fossulæ of the basis cranii. Afterwards the great cavity contracts a little toward the sides, all its other dimensions continuing the same; and behind the larynx it is again enlarged on each side, a very small space being left between it and the cricoide cartilage. The extremity of the lower portion is very narrow, and joins the basis of the cartilage just named.

471. The pharynx is made up partly of several distinct fleshy portions, which are looked upon as so many different muscles so disposed as to form a large cavity, and partly of a membrane which lines the inner surface of this whole cavity, and is a continuation of that of the nares and palate.

472. This membrane is wholly glandular, and it is thicker on the superior and middle portions of the pharynx, than on the bottom or lower portion. Immediately above the first vertebra it forms several longitudinal rugæ very thick, deep, and short, and we generally find therein a collection of mucus in dead bodies. In the great cavity there are no rugæ, the membrane adhering, both there and in the upper part, very closely to the muscles. At the lower part where it is thinnest, it covers likewise the posterior part of the larynx, and is very loose, and formed into irregular folds. It runs in a little on each side between the edges of the pharynx.

473. Though almost all the muscular or fleshy portions of which



which the pharynx is composed, concur in the formation of one continued bag or receptacle, they are nevertheless very distinguishable from each other, not only by their different insertions, from which they have been denominated, but also by the different directions of their fibres. The greatest part of them may be looked upon as digastric muscles, the middle tendons of which lie backward in one longitudinal line, which in some subjects appears plainly like a linea alba.

*Muscles of the pharynx.*

474. These muscles may be reduced into three general classes, with regard to their insertions. The first class is of those which are inserted in the basis cranii, viz. Cephalo-pharyngæi. Petro-pharyngæi. Spheno-pharyngæi, five spheno-salpingo-pharyngæi. Pterygo-pharyngæi. Stylo-pharyngæi. The second class comprehends those which are inserted toward the mouth, viz. Peristaphylo-pharyngæi. Glosso-pharyngæi. Hypo-pharyngæi. Genio-pharyngæi. The third class includes those inserted in the lateral parts of the larynx, viz. Syndesmo-pharyngæi. Thyro-pharyngæi. Crico-pharyngæi. Oesophagus. Adeno-pharyngæus.

475. The cephalo-pharyngæi are inserted in the lower side of the apophysis basilaris, or great apophysis of the Os Occipitis, about the middle of the posterior part. From thence they separate laterally, and sometimes join the stylo-pharyngæi. The linea alba of the pharynx begins by the middle adhesions of these muscles.

476. The petro-pharyngæi are inserted in the lower part of the extremity of the apophysis-petrola; the spheno-pharyngæi, partly in the Os Sphenoides, directly above the internal ala of the apophysis pterygoides, and partly in the neighbouring cartilaginous portion of the Eustachian tube; and the pterygo-pharyngæi, in the edge of the same ala of the apophysis pterygoides. These three muscles on each side run obliquely backward, covering each other by some fibres, and meet at the linea alba. Their use may be to draw the middle portion or great cavity of the pharynx, upward.

477. The stylo-pharyngæi are inserted interiorly by one extremity in the apophysis, or epiphysis styloides. From thence each muscle runs down obliquely along the lateral part of the pharynx, covering and crossing the other muscles. It extends gradually in breadth as it descends, and forms two principal

portions, one superior which is narrow, and one inferior which is broad. The narrow portion is spread among the muscular fibres above the thyroide cartilage, and the broad portion is inserted in the side of that cartilage; and thus the stylo-pharyngæus is partly a true stylo-thyroidæus. These muscles may draw the pharynx laterally upward, especially by their thyroide portions; but the use commonly assigned to them of dilating the pharynx, seems conformable neither to their situation, nor to their direction.

478. The peristaphylo-pharyngæi are two small muscles inserted between the uvula and lower extremity of the internal ala of the apophysis pterygoides, and run obliquely backward on the sides of the pharynx. It is difficult to find them in very lean or young subjects, and they seem to be the same which M. Santorini calls *hypero-pharyngæi*, or *palato-pharyngæi*. The glosso-pharyngæi are fibres which run along the lateral edges of the tongue, from which they are parted backward, and run down on the sides of the pharynx under the stylo-pharyngæi.

479. The hyo-pharyngæi in general are those on each side which are inserted in the Os Hyoides; and they may be reckoned three pairs, the basio-pharyngæi, kerato-pharyngæi minores, and kerato-pharyngæi majores; these denominations being taken from their insertions in the basis, and in the small and great cornua of the Os Hyoides.

480. I have never been able to see distinctly the mylo-pharyngæi of Dr. James Douglas; all that I have hitherto found, is a muscular portion really distinct from the genio-glossus, inserted in the side of the pharynx, and for that reason I call it *genio-pharyngæus*, as being joined to the genio-glossus all the way to the chin.

481. The syndesmo-pharyngæi of Dr. Douglas are fasciculi of muscular fibres very distinctly inserted by one end along the ligaments by which the superior cornua of the cartilago-thyroides are connected to the extremities of the great cornua of the Os Hyoides. From thence they run backward, and meet at the linea alba. To be able to see them distinct from the other muscles, the pharynx must be filled with cotton to give it a proper convexity, and to support its sides, which otherwise collapse, and sink inward, and thus prevent our seeing the direction and distinction of several of the muscles belonging to it,

482. The

482. The thyro-pharyngæi are very broad, and each muscle is inserted along the outside of the ala of the cartilago thyroides, between the edge of that cartilage and the oblique line in which the thyro-hyoidæi are fixed; and they are a little confounded with the crico-hyoidæi. From thence they run up obliquely backward, and meeting under the linea alba, they sometimes appear to be but one muscle without any middle tendon. Sometimes they have appeared to me to be distinguished into superior and inferior, because their upper portion ran upward and backward, and their lower portion more transversely.

483. The crico-pharyngæi are inserted each in the lower part of the side of the cricoide cartilage. They seem to be appendices of the thyro-pharyngæi, shewing no other marks of distinction but these insertions and a small difference in direction, because as they run backward they descend a little. For this reason I have sometimes looked upon these two muscles to be one, and have called it *thyro-crico-pharyngeus*.

484. The lowest of these muscular fibres make a complete circle backward, between the two sides of the basis of the cartilago cricoides. This circle is the beginning of the œsophagus, and has been thought by some to form a distinct muscle called *œsophagus*. I have found another fasciculus of fibres detached from the thyro-pharyngæus, and inserted laterally in the thyroide-gland, for which reason I call it *musculus thyro-adenoidæus*.

485. The particular uses of all these muscles are very difficult to be determined. It is certain that those of the middle and lower portions of the pharynx serve chiefly for deglutition. Those of the upper portion, and some of those of the middle portion, may, among other functions, be useful in modifying the voice, according to the opinion of M. Santorini.

### § 3. The palate, uvula, &c.

486. The palate is that arch or cavity of the mouth, surrounded anteriorly by the alveolar edge and teeth of the upper jaw, and reaching from thence to the great opening of the pharynx. This arch is partly solid and immoveable, and partly soft and moveable. The solid portion is that  
which



which is bounded by the teeth, being formed by the two *Ossa Maxillaria*, and two *Ossa Palati*. The soft portion lies behind the other, and runs backward like a veil fixed to the edge of the *Ossa Palati*, being formed partly by the common membrane of the whole arch, and partly by several muscular fasciculi, &c.

487. The membrane that covers all this cavity is like that which lines the superior and middle portions of the pharynx. It is very thick set with small glands, the orifices of which are not so sensible as in the pharynx, and especially in the rugæ of the superior portion thereof, where M. Heister observed a considerable orifice, and a canal proportioned to that orifice, which he could easily inflate with air. This is certainly the best way of beginning these kinds of enquiries, especially if the pipe be held at first only very near the part, without endeavouring to force it in. To immerge the parts in clear water in the manner already mentioned, is likewise a very good way to discover small orifices, by the help of a microscope. Small ducts of the same kind with what I have now mentioned, may be supposed to lie along the middle line or raphe of the arch of the palate, and along the alveolar edge, because of some small tubercles or points which appear there.

488. This membrane, together with that of the posterior nares, forms, by an uninterrupted continuation, the anterior and posterior surface of the soft portion, or septum palati; so that the muscular fasciculi of this portion lie in the duplicature of a glandulous membrane. The muscles composed of these fasciculi shall be presently described.

489. The septum which may likewise be termed *velum*, or *valvula palati*, terminates below by a loose floating edge, representing an arch situated transversely above the basis or root of the tongue. The highest portion or top of this arch sustains a small, soft, and irregularly conical glandulous body, fixed by its basis to the arch, and its apex hanging down without adhering to any thing, which is called *uvula*.

490. On each side of the uvula there are two muscular half-arches, called *columnæ septi palati*. They are all joined to the uvula by their upper extremities, and disposed in such a manner as that the lower extremities of the two which lie on the same side, are at a little distance from each other, and

so as that one half-arch is anterior, the other posterior, an oblong triangular space being left between them, the apex of which is turned toward the basis of the uvula.

491. The two half arches on one side, by joining the like half-arches on the other side, form the entire arch of the edge of the septum. The posterior half-arches run by their upper extremities, more directly toward the uvula than the anterior. The anterior half-arches have a continuation with the sides of the basis of the tongue, and the posterior, with the sides of the pharynx. At the lower part of the space left between the lateral half-arches on the same side, two glands are situated, termed *amygdalæ*, which shall be described hereafter, together with the glandular structure of the uvula, among the other glands of the mouth.

492. The half-arches are chiefly made up of several flat fleshy portions, almost in the same manner with the body of the septum. The membrane which covers them is thinner than the other parts of it towards the palate, pharynx, and tongue. Each portion is a distinct muscle, the greatest part of which terminate by one extremity in the substance of the septum and of the half-arches, and by the other extremity in parts different from these.

493. As anatomists used formerly to ascribe all these muscles, as far as they knew them, to the uvula, without any regard to the septum, they termed them in general either *ptery-staphylini*, or *peri-staphylini*. The last part of these two compound words expresses the uvula; the first part of the first word is an abridgement of *pterygoides*, and expresses the insertion of these muscles, but the first part of the second word signifies no more than round, or about, &c.

494. I should be very glad to make use of the term *peri-staphylinus* as a general denomination for the muscles belonging to the septum, and then to add the other terms, of which these names have been made up by modern writers. But lest I should be thought to affect a language different from the common, I shall retain the ordinary names, only desiring the reader to take notice that by the term *staphylini* I do not mean precisely the uvula, but only the parts round it. If we could be allowed to frame names of Greek and Latin words compounded together, we might, for example, say *glosso-palatinus*, instead of *glosso-staphylinus*. I shall call  
the

the muscles that go to the uvula, simply *staphylini*, or *epistaphylini*, because that part resembles a small bunch of grapes, according to the signification of the Greek word. From what has been said, I name these muscles in the following manner. *Glossostaphylini*. *Pharyngo-staphylini*. *Thyrostaphylini*. *Pterygo-staphylini*. *Spheno-salpingo-staphylini*, called commonly *peristaphylini externi*. *Pterygo-staphylini superiores*. *Pterygo-staphylini inferiores*. *Pterygo-salpingo-staphylini*, called commonly *ptery-staphylini interni*. *Staphylini sive epistaphylini*.

495. The *glossostaphylini* are two small muscles, fixed each in the lower and lateral part of the basis of the tongue; from whence they run up obliquely backward, along the anterior half-arches of the septum palati, and terminate insensibly on each side near the uvula, some of their fibres being spread through the septum. The thickness of the anterior half-arches is chiefly owing to these two muscles.

496. The *pharyngo staphylini* are likewise two small muscles, each of them being fixed by one extremity to the lateral part of the musculi thyro-pharyngæi, as if they were portions detached from these muscles. From thence they run up obliquely forward along the two posterior half arches of the septum, and terminate in the septum above the uvula, where they meet together, and seem to form an entire arch by the union of their fibres. The thickness of the two posterior half-arches is owing to these muscles:

497. The *thyro-staphylini* are two small muscles, which accompany the *pharyngo-staphylini* very closely, through their whole course, except that their posterior extremities are fixed in the thyroide cartilages near the other muscles. They likewise contribute to the thickness of the posterior half arches, and are inserted in the septum in the same manner with the former. These two pairs of muscles may be made one pair, and may be called *thyro-pharyngo-staphylini*.

498. The *spheno-salpingo-staphylini* are each fixed by one extremity, partly to the sphenoidal side of the bony portion of the Eustachian tube, partly to the nearest soft portion of the same tube. From thence it runs toward the external ala of the apophysis pterygoides, into which one portion of this muscle is inserted. The other portion runs to the end of the ala, and turns round to the forked extremity thereof as

over



over a pulley, and is afterwards inserted in the septum palati near the uvula.

499. I look upon these two portions as two distinct muscles, one of which ending in the ala, seems only to serve for the dilatation of the tuba Eustachiana. The other portion is a true spheno-staphylinus, and as it has likewise an insertion in the tube, it may be termed *spheno-salpingo-staphylinus*, or *staphylinus externus*. This is the muscle commonly called *peri-staphylinus externus*.

500. The pterygo-staphylinus superior is only the external portion of the muscle last described; and this name may likewise be given it, because it has a small insertion in the upper part of the apophysis pterygoides, besides that in the sphenoidal part of the bony portion of the tube. The pterygo-staphylinus inferior on each side, is a small muscle inserted by one extremity in the uncus pterygoidæus, and by the other in the septum near the uvula. This observation we owe to M. Heister.

501. The petro-salpingo-staphylini, or salpingo-staphylini interni, are those which are commonly called *peristaphylini interni*. Each muscle is fixed by one extremity, partly to the inner side of the bony portion of the Eustachian tube, or that next the apophysis petrosa, partly along the cartilaginous portion of the same tube. From thence it passes a little way under the soft membranous part, and toward what I called the *half-pad* of the tube, and then turning toward the septum, is fixed in the edge, and partly in the upper side thereof.

502. The staphylini, or epistaphylini are two small fleshy ropes, closely united together, as if they made but one muscle, but in some subjects they are distinguished by a very fine white line. They are fixed by one extremity in the common point of the posterior edges of the Osia Palati, and from thence run downward and backward along the middle of the septum, and likewise along the middle of almost the whole uvula. These muscles have been termed *azygos Morgagnii*, from the discoverer, but he considered them as one muscle. The pterygo-staphylini inferiores are of the same kind, and might be termed *staphylini*, or *epistaphylini laterales*, and these last, *medii*.

503. The septum palati serves to conduct the lacrymal  
 Vol. II. 3 K lymphæ,

lymphæ, and that which is continually collected on the arch of the palate, into the pharynx. It serves for a valve to hinder what we swallow, and especially what we drink, from returning by the nares. The uses of the different muscles of the septum are not as yet sufficiently known, nor the different motions of which it is capable, as may be observed by looking for some time into an healthy person's mouth opened wide. I shall endeavour to explain these things at greater length in another place.

#### § 4. *The tongue.*

504. Every one knows that the tongue is a soft fleshy body, which fills all that part of the cavity of the mouth that is surrounded by the alveolar border and teeth of the lower-jaw, and extends still further back. All this space is therefore in a manner the mould and measure of the length and breadth of the tongue, as well as of its thickness and figure.

505. The tongue is divided into the basis and point; the upper and under sides; and the lateral portions or edges. The basis is the posterior and thickest part; the point, the anterior and thinnest part. The upper side is not quite flat, but a little convex, and divided into two lateral halves, by a shallow depressed line, called *linea lingue mediana*. The edges are thinner than the other parts, and a little rounded as well as the point. The lower side reaches only from the middle of the length of the tongue to the point.

506. The tongue is principally composed of very soft fleshy fibres, intermixed with a particular medullary substance, and disposed in various manners. Many of these fibres are confined to the tongue without going any farther, the rest form separate muscles which go out from it in different ways, and are inserted in other parts. All the upper side of the tongue is covered by a thick membrane of a papillary texture, upon which lies another very fine membrane like a kind of epidermis, which is likewise continued over the lower side, but without papillæ.

507. Three sorts of papillæ may be distinguished in the upper side of the tongue; capitatae, semi-lenticulares, and villosæ. Those of the first kind are the largest, resembling little mushrooms with short stems, or buttons without a neck.

They

They lie on the basis of the tongue in small superficial fossulæ.

508. They resemble small conglomerate glands seated on a very narrow basis, and each of them has sometimes a small depression in the middle of their upper or convex side. They occupy the whole surface of the basis of the tongue, and they are situated near each other in such a manner as that the most anterior form an angle. They are glandular papillæ or small salival or mucilaginous glands, of the same kind with those that are to be described hereafter.

509. We oftentimes observe about the middle of this part of the tongue a particular hole of different depths, the inner surface of which is entirely glandular, and filled with small papillæ, like those of the first kind. It is called *foramen cæcum Morgagnii*, as being first described by that author. Since that time M. Vaterus has discovered a kind of salival ducts belonging to it: and M. Heister found two of these ducts very distinctly, the orifices of which were in the bottom of the foramen cæcum near each other. He observed the ducts to run backward, divaricating a little from each other, and that one of them terminated in a small oblong vesicle situated on the side of the small cornu of the Os Hyoides.

510. The papillæ of the second kind or semilenticulares, are small orbicular eminences, only a little convex, their circular edge not being separate from the surface of the tongue. When we examine them in a sound tongue, with a good microscope, we find their convex sides full of small holes or pores, like the end of a thimble.

511. They lie chiefly in the middle and anterior portions of the tongue, and are sometimes most visible on the edges, where they appear to be very smooth and polished even to the naked eye, and sometimes in living subjects. They soon lose their consistence after death, so that, by rubbing them several times, they may be drawn out in form of small soft pyramids inclined to one side.

512. The papillæ of the third kind or villosæ are the smallest and most numerous. They fill the whole surface of the upper side of the tongue, and even the interstices between the other papillæ. They would be more properly named *papillæ conicæ* than *villosæ*, from the figure which they appear



to have when examined through a microscope in clear water. They are naturally softish, but they become extremely flaccid after death, so that by handling them they may be made short and thick, whereas they are naturally long and small.

513. The fleshy fibres of which the tongue is composed, and which go no further than the tongue, may be termed *musculi linguae interiores*, or the *intrinsic muscles*, and they are the same which Spigelius named *musculi linguales*. The fibres these muscles consist of, are of three general kinds, longitudinal, transverse, and vertical; and each of these situations admits of different degrees of obliquity. The longitudinal fibres point to the basis and apex of the tongue, and seem partly to be expansions of the *musculi stylo-glossi*, *hyo-glossi*, and *genio-glossi*, of which hereafter. The vertical fibres seem likewise to be in part produced by the same *genio-glossi*, and the transverse, by the *mylo-glossi*.

514. Besides these mixed productions, there is a distinct plane of longitudinal fibres, which run near the surface of the upper side of the tongue, and a distinct transverse plane under them. All these fibres are partly interwoven, one portion of them terminating at the two edges of the tongue, and the other at the basis and point, without going to any other part; and they lie immediately above those that belong to the *genio-glossi*. To discover all these different fibres, and their different degrees of direction, we need only cut the tongue longitudinally, after it has been boiled, or long macerated in strong vinegar.

515. The extrinsic muscles, or *musculi exteriores*, are those which by one extremity make a part of the body of the tongue, and are fixed by the other in some part without the tongue. Of these we commonly reckon four pairs: *Mylo-glossi*. *Stylo-glossi*. *Hyo-glossi*. *Genio-glossi*.

516. The muscles which move the *Os Hyoides* already described in sect. 3, belong likewise to the tongue, and are the principal directors of its motions. The names of these muscles may be remembered to be as follows: *Mylo-hyoidæi*. *Genio-hyoidæi*. *Stylo-hyoidæi*. *Omo-hyoidæi*. *Sterno-hyoidæi*.

517. The *mylo-glossi* are small fleshy planes situated transversely, one on each side, between the ramus of the lower jaw, and the basis of the tongue. Their insertion in the jaw is.

is immediately above the posterior half of the mylo-hyoidæus, between the prominent oblique line on the inside of the bone, and the dentes molares. From thence they run toward the basis of the tongue, and are lost there on one side of the glosso-pharyngæi. These muscles are often wanting.

518. The stylo-glossi are two long, small muscles which run down from the styloide apophyses or epiphyses, and form two portions of the lateral parts of the tongue. Each muscle is fixed in the outside of the apophysis styloides by a long tendon, being the uppermost of the three muscles fixed in that apophysis, which at Paris go by the name of *Riolan's nosegay*. The stylo-hyoidæus is the lowest, and the stylo-pharyngæus is in the middle, but more backward.

519. As it runs down almost opposite to the inside of the angle of the lower jaw, it sends off a pretty broad and short lateral aponeurotic ligament, which being fixed in that angle, serves for a frænum, or ligamentum suspensorium to the muscle in this part of its course. From thence it passes on to the side of the basis of the tongue, where it first of all adheres closely to the lateral portion of the hyo-glossus, and then forms, together with that muscle, a large portion of the side of the tongue.

520. The hyo-glossi are each inserted in three parts of the Os Hyoides that lie near each other; in the basis, in the root of the great cornu, and in the symphysis between these two, and on this account the hyo-glossus has been divided by some into two or three distinct muscles, called *basio-glossus*, *ceratoglossus*, and *chondro-glossus*. In some subjects they may be easily separated, the three portions being simply contiguous to each other; but it is needless to burden the memory with so many useless names, and therefore I describe them all as one muscle, by the name of *hyo-glossus*.

521. It is situated on the inside, and a little lower than the stylo-glossus, with which it forms the lateral part of the tongue. The portion inserted in the basis of the Os Hyoides lies more anteriorly, and is larger than the other two; that which is inserted in the symphysis is the least, and that inserted in the great cornu, the most posterior. This muscle is partly sustained by the mylo-hyoidæus, as by a girth; and the anterior portion is distinguished from the rest by the passage

sage of the nerves of the fifth pair, and of the arteries which accompany them.

522. The *genio-glossi* are situated close to each other, on the lower side of the tongue. Each muscle is inserted in the inner or backside of the symphysis of the lower jaw, immediately above the *genio-hyoidæus*. From thence it runs backward toward the *Os Hyoides*, to which the lowest fibres are connected by a ligamentary membrane; and in this course its fibres are spread through the substance of the tongue in a very singular manner,

523. Of these fibres some run directly toward the *Os Hyoides*, all the way to the basis of the tongue; some are inflected forward, and go to the point of the tongue; and the rest are distributed in a radiated manner, forward, upward, and backward in the substance of the tongue; and the middle fibres expand laterally toward the edges of the tongue.

524. The two *genio-glossi* run close to each other, as if they formed but one mass; but they are evidently divided by a very thin cellular membrane, or middle septum, which penetrates a good way between the lateral, or right and left halves of the tongue, lying in the same plane with the *linea mediana* of the upper side of the tongue.

525. When we separate these two muscles from the chin, they presently contract so much, that their anterior extremities which lay under the point of the tongue, are as far back as the middle of it. It is in this preternatural situation that we see these muscles represented in figures given by very great anatomists, and drawn and engraved by very good artists, in which figures the whole beauty of their true mechanism is lost.

526. These two muscles, by their posterior straight fibres which go to the basis, can draw the tongue out of the mouth, and bring it back again by their anterior bent fibres which go to the point. They can either successively, or all at once, make the tongue longitudinally hollow, or like a groove; and they can at the same time contract it, by the lateral expansion of the middle fibres. I pass over many other motions which these muscles are capable of performing, from whence I formerly used in my private courses to call them *musculi-polychresti*.

527. When either of the *stylo-glossi* acts, it turns the tongue



tongue toward the cheek, and forces the aliment between the upper and lower molares. When they act jointly with the lateral portions of the superior fleshy plane of the tongue, they turn the tongue obliquely upward to the teeth of the upper jaw, and near the cheeks, as when we bring down any part of the food that may have stuck there, after mastication. When they act jointly with the lateral portions of the hyo-glossi, they turn the tongue downward between the lower teeth and the cheek.

528. When all the parts of the hyo-glossi act together, they shorten the tongue. They likewise turn the point of the tongue between the teeth and the under lip, and make it pass over that lip. The superior fleshy plane of the body of the tongue bends it upward toward the palate, and makes it pass along and lick the upper lip. The mylo-glossi serve as a frænum to one side of the basis while the point is turned to the other side. The ligamenta suspensoria of the stylo-glossi may answer the same purpose, and even supply the want of the mylo-glossi.

529. Besides the membranes of the tongue already described, it is customary to mention another, called *membrana reticularis*, which is commonly demonstrated from the boiled tongues of oxen or sheep; and some pretend to have shewed it in the human tongue, which I own I have never been able to do. It is now a long time since I shewed that what they take from the tongues of oxen and sheep is not a true membrane, but a kind of clear mucilaginous substance, which lies between the papillary and external membranes, and which by boiling becomes white, and acquires solidity enough to be taken out in large portions, and that the holes found in it are owing to the small pyramidal papillæ.

530. The tongue is fixed in the mouth, not only by muscles, but also by ligaments, which are for the most part membranous. The principal ligament is that called *the frænum*, which is the prominent fold that appears first under the tongue, when we raise it, with the mouth opened, and is no more than a continuation or loose duplicature of that membrane which covers the interior cavity of the mouth. It covers the curvature of the anterior portion of the genio-glossi from the point of the tongue, almost as high as the middle interstice between the lower dentes incisarii.

531. The other ligaments of the tongue are the small membranous fold which runs along the middle of the convex side of the epiglottis to the basis of the tongue; and the membranous folds which cover the inferior half-arches of the septum palati. These three folds are continuations of the membrane which covers the neighbouring parts. The aponeurotic ligaments of the stylo-glossus may be looked upon as true lateral ligaments of the tongue; and they adhere a little to the lower part of the musculus pterygoideus internus, or anterior.

532. The principal blood vessels of the tongue are those that appear so plainly on its lower surface, on each side of the frænum; and they consist of one artery and one vein, which accompany each other, and are called *arteriæ & venæ sublinguales* or *raninæ*. The veins lie next the frænum, and the arteries on the other side of the veins. The arteries are rami of the second internal or anterior branch of the external carotid on each side, and communicate with the first external or posterior branch of the same carotid, &c. The veins are commonly rami of a branch of the external anterior jugular vein, described among the other veins, sect. 5. N<sup>o</sup> 79.

533. We observe four nervous ropes to go very distinctly to the basis of the tongue, and to continue their course through its whole substance all the way to the point. Two of these ropes are rami of the inferior maxillary nerves, or of the third branch of the fifth pair from the medulla oblongata. The other two are the nerves of the ninth pair. The two first I have already named *linguales* or *hypo-glossi minores*, and the other two *linguales* or *hypo-glossi majores*. The majores are inferior and internal, the minores superior and external, or lateral. The small portion or first branch of the nervus sympathicus medius, or of the eighth pair, sends likewise a nerve to each side of the tongue.

534. The great lingual nerve on each side runs forward between the musculus mylo-hyoidæus and hyo-glossus, under the genio-glossus, and is distributed to the fleshy fibres all the way to the point of the tongue, communicating by several small filaments with the lingualis minor, and with the nerve from the eighth pair. For the other distributions of it, I refer to the description of the nerves.

535. The small lingual nerve on each side goes off from the

the maxillaris inferior, sometimes at, and sometimes before its passage between the pterygoide muscles. Afterwards separating more and more from the trunk, it passes under the lateral part of the tongue, over the sublingual gland, of which hereafter. It supplies the nearest parts of the tongue as it passes, and then entering its substance, terminates at the point, having sent a great number of filaments to the papillary membrane. It communicates, as has been said, with the lingualis major, and with the nerve from the eighth pair.

536. This lingual nerve, a little after it leaves the maxillaris inferior, is accompanied by a small distinct nerve, which runs upward and backward toward the articulation of the lower jaw, in company with the lateral muscle of the malleus, passes through the tympanum between the handle of the malleus and the long leg of the incus, by the name of *chorda tympani*, and afterwards perforating the backside of the tympanum, unites with the portio dura of the auditory nerve, as has been already said in the description of the ear.

537. This small nervous rope has been looked upon by anatomists as a kind of small recurrent of the nervus lingualis; but as in some subjects it appears to make simply an acute angle with the lingual nerve, and as this lingual nerve is something larger after this angle, it ought rather to be believed to come from the tympanum, and to unite with the lingual nerve, than to arise from this nerve, and run up to the tympanum. In some subjects the union of this nerve with the lingualis is in a manner plexiform, and very difficult to be unfolded.

538. The lingual nerve of the eighth pair, which is its first branch, runs first of all on the inside of the digastric muscle of the lower jaw, and supplies the genio-hyoidæi, the neighbouring muscles of the basis of the tongue and those of the pharynx. Afterwards it sends out the ramifications, and forms the communications described in the history of the nerves; and lastly goes to the lower part of the tongue, where it communicates with the lingual ramus of the fifth pair, and with the lingual ramus of the ninth.

539. The tongue is the organ of the sense called the *taste*, by means of the papillæ, especially the villosæ or pyramidalles. It is not as yet discovered in what manner the papillæ



semi-lenticulares contribute to the taste; and the capitata ought to be looked upon as salival glands.

540. The tongue is likewise one of the principal instruments of speech, and of the articulation of the voice. Riolan in his anthropographia mentions a child of five years of age, who though he had lost his tongue by the small-pox, but not the uvula, continued still to speak almost as distinctly as before. Probably the basis of the tongue still remained. M. de Jussieu has published an observation in the memoirs of the royal academy concerning a little girl who could speak, though she was born without a tongue, in room of which there was only a kind of small tubercle.

541. The tongue serves also to collect all the morsels which we chew, to turn them in different manners and to different parts of the mouth, and to rub off whatever sticks to the palate; and it is useful in spitting, sucking, &c. It bears a great part in deglutition, being assisted by the digastric muscles, which by contracting at the same time that the other muscles press the lower jaw against the upper, raise the Os Hyoides, and fix it at a convenient height; that the styloglossi and hyoglossi may make the basis of the tongue bear back upon the morsel which is to be swallowed, and so force it into the pharynx, the portions of which that are at that time immediately above the morsel, do instantly contract, and push it into the œsophagus.

#### § 5. *The cheeks, lips, and gums.*

542. The cheeks and lips form the sides and entry of the cavity of the mouth. They are formed in general by the connection of several fleshy portions of different breadths, fixed round the convex sides of the two jaws, covered on the outside with the skin and fat, and lined on the inside by a glandulous membrane. Besides all this, the lips seem likewise to have a soft spongy substance in their composition, which swells and subsides on certain occasions independently of the action of the muscles belonging to them, and is mixed with fat.

543. The substance which forms the red border of the lips is very different from the rest of the skin, being a collection of very fine, long, villous papillæ, closely connected together and covered by a fine membrane, which seems to be both

both a continuation of the epidermis, and of that pellicle which covers the glandulous membrane of the cavity of the mouth. This substance is extremely sensible, and very painful when the outer membrane is by any accident destroyed. The internal membrane of the upper lip forms a small middle frænum above the first dentes incisorii.

544. The gums are that reddish substance like leather, which covers the two sides of the whole alveolar border of both jaws, insinuates itself between all the teeth, surrounds what I called the *collar of each tooth in particular*, and adheres very strongly to them. Therefore the outer and inner gums are continuous, and both together form just as many openings as there are teeth.

545. The substance of the gums is of a very singular structure, resembling in some measure the texture of a hat, supposed to be very compact and elastic. It is not immediately fixed to the bones of the jaws, but by the intervention of the periosteum with which it is perfectly united; and it is covered by a fine strong, even membrane, which sticks very close to the substance of the gums, and seems to be a continuation of that thin membrane which goes to the lips and cheeks, and of that which goes to the tongue.

546. The arteries which go to the lips, cheeks, and gums, are ramifications of the external carotid, and chiefly of those branches called *maxillares externæ & internæ*, of which I desire the reader to consult the distributions and different communications in the description of the arteries, N<sup>o</sup> 55. 58. The veins are ramifications of the external anterior jugular.

547. The nerves of these parts come from the maxillaris superior and inferior, which are branches of the fifth pair; and also from the portio dura of the auditory nerve, or sympatheticus minimus, the ramifications of which are spread in great numbers on all these parts, and communicate in a pretty singular manner with the nerves of the fifth pair in several places, as may be seen in the description of the nerves.

548. There is so much variety to be met with in the muscles of the lips in different subjects, that it is not at all surprising to find the descriptions given of them by anatomists very unlike one another. In some subjects portions of these muscles are wanting; in some they can scarcely be distinguished, because of the paleness and attenuation of the fibres; and in o-

thers there are really some particular fasciculi which are not generally to be found. About fifteen years ago I dissected an old woman, in which subject alone I observed a great many singular things which I have not met with in great numbers of other subjects more proper for dissection. In this subject the muscles of the face in general were very much multiplied, and very distinct, as I shall shew in particular observations.

549. The muscles of the lips are commonly divided into common and proper. The common muscles are those which end at the angles or commissures of the two lips; and those are proper which are fixed in one lip only, which are again subdivided into the proper muscles of the upper lip, and proper muscles of the under lip. All these muscles have particular names, some of which are taken from something in the conformation of the muscles, some from the insertions or situation, and some from the uses attributed to them.

550. I shall here describe those which I am able to shew, without mentioning those which I have not hitherto found, though I am in no doubt about the accuracy of those great anatomists who have published accounts of them, and who have besides given unquestionable proofs of their being faithful and judicious observers. I shall lay aside the names taken from the supposed uses, partly because I have done so all along for reasons already given, partly because I am still uncertain about some of the uses attributed to them, and partly to encourage anatomists and even beginners to try their hands at guessing, at which they may perhaps succeed better than I have done.

551. The muscles to which I confine myself may be enumerated in the following order. *Musculi communes*: Semi-orbiculares. Supra-semi-orbiculares. Buccinatores. Zygomatici majores. *Musculi proprii labii superioris*: Zygomatici minores. Canini. Incisarii laterales. Incisarii medii. *Musculi proprii labii inferioris*: Triangulares, Triangularem collaterales. Quadratus. Incisarii inferiores. Cutanei.

552. The upper lip is sometimes moved by the action of the muscles of the nose, especially of the pyramidales; and both lips either jointly or separately are moved by suction, without the assistance of the muscles belonging to them.

553. The semi-orbiculares are commonly looked upon as  
one



one muscle, surrounding both lips, from whence it is called *orbicularis*; but when we examine carefully the angles of the lips, we find that the fibres of the upper lip intersect those of the under lip, and we easily distinguish the muscular arch of one lip from that of the other; and for this reason I divide this muscle into two, and I call them by the common name of *semi orbicularis*, or I call one of them *semi-orbicularis superior*, and the other *semi-orbicularis inferior*; but the name of *semi-ovales* would be still more proper.

554. The superior semi-orbicular muscle is oftentimes broader than the inferior; and it has this peculiarity likewise, that all its fibres do not go to the corner of the mouth, but terminate by degrees between the middle and extremities of this arch, nearly like the semi-oval fibres of the upper palpebra. The inferior semi-orbicular muscle is commonly more uniform in the disposition of its fibres.

555. The supra semi-orbiculares are fibres which increase the breadth of the two lateral portions of the superior semi-orbicularis, upward; and they appear at first sight to be one continued arch like the muscle last named, but being narrowly examined, they will be found to be separated by a small interstice lying betwixt their contiguous extremities which are fixed in the gums opposite to the edges of that cutaneous fossula that runs down from the septum narium to the middle of the edge of the upper lip. Their other extremities are confounded with those of the semi-orbicularis superior.

356. The buccinatores are two in number, each of them situated transversely between the posterior part of the two jaws and the corner of the mouth. They are broad backward and narrower forward, in the shape of a triangle or trapezium, and they form a considerable portion of the cheeks, and for that reason are sometimes called the *muscles of the cheeks*. To have a just idea of these muscles, we must be made acquainted with a ligament on each side of the face which I call *ligamentum inter-maxillare*, because it connects the two jaws, and also gives insertion to the posterior fibres of the buccinator.

557. This ligament is strong and pretty broad. It is fixed by one end to the outside of the upper jaw above the last dens molaris, and at the side of the apophyses pterygoïdes where.

where it adheres very closely to the *musculus pterygoidæus internus*. By the other end it is fixed in the posterior or superior extremity of the oblique prominent line on the outside of the lower jaw, below the last *dens molaris*. It serves likewise as a *frænum* to check and limit the depression of the lower jaw in opening the mouth, and we may feel it ourselves, with the end of the finger in the mouth, especially when it is wide open.

558. The *buccinator* is inserted posteriorly in three different places. The middle fibres are fixed transversely in the *ligamentum intermaxillare*, and run directly to the corner of the mouth. The superior fibres run down in an oblique graduated manner, from the *alveoli* of the upper jaw to the corner of the mouth; and the inferior fibres run up from the lower jaw in the same manner. All these fibres contract by degrees as they approach the commissure of the lips, where they run in behind the extremities and union of the *femi-orbiculares*, by which they are covered, and to which they adhere closely. There is a large hollow between this muscle and the *masseter* filled with fat.

559. The *zygomatici majores* are two muscles situated, one on each side, between the *zygoma* and the corner of the mouth. Each muscle is thin, long, oblique, and fixed by one extremity to the lower edge of that portion of the *Os Malæ*, which is connected with the *zygomatic apophysis* of the *Os Temporis*. From thence it runs down obliquely from behind forward, being in its passage commonly involved in fat. It ends at the commissure of the two lips, adhering strongly to the *buccinator* which covers it. This muscle is very often complex.

560. The *zygomatici minores* are two small slender muscles, lying above the great *zygomatici*, and almost parallel to them. Their superior extremity seems to be a detachment from the lower fibres of the *orbicularis palpebrarum*; but they may always be distinguished. Their lower extremity unites with the neighbouring *incisorius*. These muscles are quite buried in fat, and for that reason often disappear.

561. Each of the two *canini* is fixed by a broad insertion in the upper jaw above the socket of the *dens caninus*, in a depression below the inferior edge of the orbit near the *Os Malæ*. From thence it runs down a little obliquely, crossing

sing the lower extremity of the zygomaticus major, which covers it at this place. Afterwards it terminates at the extremity of the arch of the semi-orbicularis superior, and communicates by some fibres with the triangularis. I formerly looked upon this as a neutral muscle, that is, as being neither a proper muscle of the upper lip, nor common to both.

562. Each of the two incisorii laterales is a sort of biceps, its upper part being divided into two portions which unite below. One of these superior portions is larger than the other, and is fixed in the Os Maxillare below the middle tendon of the orbicularis palpebrarum, seeming to communicate by some fibres with the contiguous fibres of that muscle. From thence it runs down a little obliquely toward the cheek, along the apophysis nasalis, mixing with the pyramidalis nasi, and sending some fibres to the nares. Afterwards it passes over and adheres to the myrtiformis, or transversalis nasi, and unites with the other portion.

563. This other portion is fixed by a broad insertion immediately below the edge of the orbit, in the Os Maxillare, near the union of this bone with the Os Malæ, and likewise a little in the last named bone, being at this place covered by the inferior portion of the orbicularis palpebrarum, with which it has sometimes a kind of communication. From thence it runs down obliquely toward the nose, and unites with the first portion.

564. The two portions thus united and contracting in breadth, run behind the semi-orbicularis superior, and are fixed therein opposite to the lateral dens incisorius. Sometimes it sends a small fasciculus of fibres to the musculus caninus, which may be reckoned an assistant to that muscle, and named *caninus minor*.

565. The incisorii medii are commonly called *incisorii minores Cowperi*, or *incisorii minores superiores*. They are two small short muscles situated near each other below the septum narium. They are fixed by one extremity in the Os Maxillare, on the alveoli of the first incisores behind the semi-orbicularis superior, and by their other extremity in the middle and superior part of the substance of the upper lip, near the nares, in which they likewise have an insertion; and they sometimes send lateral fibres to the semi-orbicularis.

566. Each



566. Each of the two triangulares is fixed by a broad extremity in the outside of the basis of the lower jaw, from the masseter to the hole near the chin. From thence it ascends, contracting in breadth in a bent triangular form, runs in between the extremities of the buccinator and zygomaticus major, to both which it adheres very closely, and terminates at the commissure of the lip, partly in the semi-orbicularis superior, and partly, though not always equally, in the semi-orbicularis inferior. This muscle seems sometimes to be a continuation of the caninus major.

567. The quadratus forms the thick part of the chin below the under lip. It is a very complex muscle, and very difficult to be prepared, because its fibres are interwoven with a great quantity of fat, or a pellicular texture of the membrana adiposa. It is first of all inserted in the foreside of the lower jaw, where it partly fills the broad fossula on each side of the symphysis. From thence it runs up, intersecting, along the symphysis, the contiguous fibres of the skin, and terminates by a broad insertion in the semi-orbicularis inferior. The direction of the other fibres of which it is composed, varies in different subjects, and it communicates by some fibres with the cutanei.

568. The incisorii inferiores are two small muscles, commonly mentioned with the addition of M. Cowper's name. Each of them is fixed by the superior extremity, on the alveoli of the lateral incisores of the lower jaw. From thence they run down, approaching each other, and are inserted together in the lower part of the middle of the semi-orbicularis inferior.

569. On the outside of the superior insertion of each of these muscles, we meet with a fasciculus of fibres which seem to be detached from it near the incisors. This fasciculus goes off laterally in form of an arch, and unites with the fibres of the semi-orbicularis inferior, with which it may be easily confounded. It may be looked upon as a musculus accessorius to the semi-orbicularis inferior, or as a collateralis to the incisorius minor.

570. The two muscoli cutanei form a kind of fleshy membrane, which covers the whole foreside of the throat and neck, from the cheek and chin, all the way down below the claviculæ, and adheres very strongly to the membranous or aponeurotic

aponeurotic expansion described above N<sup>o</sup> 196. 197. This expansion has a particular adhesion to the anterior portion of the basis of the lower jaw, of the same kind with that at the lower part of the zygoma, and it is spread over all the muscles that lie round the neck, and over the upper portion of the pectorales majores, deltoides, and trapezii.

571. The fibres of each cutaneous muscle run obliquely upward and forward, and meet and seem to intersect those of the other muscle at acute angles, from the sternum all the way to the chin. They adhere very closely to the skin by the intervention of the cellular substance. From the clavicles to the upper part of the neck these muscles are very thin, and from thence increase a little in thickness as they approach the basis of the lower jaw, and especially from the masseter to the chin.

572. They adhere strongly to the lower portion of the masseter, triangularis, and quadratus, and on the masseter and buccinator their fleshy fibres become aponeurotic, but continue longer on the triangularis, being mixed with the fibres of that muscle all the way to the commissure of the lips. They likewise advance a little on the neighbouring portion of the quadratus.

573. The portion of these muscles which answers to the basis of the triangularis, is in a manner divided into two fleshy laminæ, the outermost of which is what advances over the triangularis and quadratus, the other being inserted separately in the lower jaw. I have sometimes observed a part of the fleshy extremity of the right side, to pass before the symphysis of the chin, over a like part from the left side, the one covering the other.

574. The common muscles of the lips either draw both corners of the mouth at once, or only one at a time, according to the different direction of their fibres. The proper muscles pull the different parts of the lips in which they are inserted. The buccinators in particular may serve to move the food in mastication. An entire treatise might be written on the almost innumerable combinations of the different motions of all these muscles, according to the different passions, and according to the different postures in which a man may put his face, as I shall shew elsewhere. None are more affecting, than those produced by the cutanei alone, especially in weeping, which

they do by their adhesions to the triangulares, &c. But by their insertions in the bone of the lower jaw, they draw up the lower part of the integuments of the neck, and those of the breast next to these; for they cannot move the jaw. In old people, and in those who are very much emaciated, these muscles may be perceived by the eye, under the chin, and on the neck.

### § 6. *The salival glands, &c.*

575. By saliva we mean in general, that fluid by which the mouth and tongue are continually moistened in their natural state. This fluid is chiefly supplied by glands, called for that reason *glandulæ salivales*, of which they commonly reckon three pairs, two parotides, two maxillares, and two sublinguales. These are indeed the largest, and they furnish the greatest quantities of saliva; but there are a great number of other lesser glands of the same kind, which may be reckoned assistants or substitutes to the former. All these may be termed *salival glands*, and they may be enumerated in the following manner: *Glandulæ parotides*. *Glandulæ maxillares*. *Glandulæ sublinguales*. *Glandulæ molares*. *Glandulæ buccales*. *Glandulæ labiales*. *Glandulæ linguales*. *Amygdalæ*. *Glandulæ palatinæ*. *Glandulæ uvulares*. *Glandulæ arytenoidææ*. *Glandula thyroidæa*.

576. The parotides are two large, whitish glands, irregularly oblong and protuberant, situated on each side, between the external ear, and the posterior or ascending ramus of the lower jaw, and lying on some part of the neighbouring masseter muscle. The superior portion of this gland lies before the cartilaginous meatus of the ear, and touches the apophysis zygomatica of the Os Temporis; and it is extended forward and backward under the lobe of the ear, as far as the mastoide apophysis.

577. From the anterior and superior portion of this gland, a white membranous duct or canal is produced by the union of a great number of small tubes representing so many roots. This duct runs obliquely forward on the outside of the masseter, and then perforates the buccinator from without inward, opposite to the interstice between the second and third dentes



dentes molares, where the hole or orifice represents the spout of an ewer.

578. This canal is named *ductus salivaris Stenonis*, or *ductus superior*. It is about the twelfth part of an inch in diameter, and in some subjects is partly covered by small glandular bodies united with it in different quantities. The arteria and vena angularis run up over this duct, and the portio dura of the auditory nerve runs through the gland itself; and it also receives filaments from the second vertebral pair.

579. The maxillary glands are smaller and rounder than the parotides, and are situated each on the inside of the angle of the lower jaw, near the musculus pterygoidæus inferior. From the inside, or that which is turned to the musculus hyoglossus, each of them sends out a duct in the same manner as the parotides, but it is smaller and longer, and goes by the name of *ductus salivaris Whartoni*, or *ductus inferior*.

580. This duct advances on the side of the musculus genio-glossus, along the inner part and superior edge of the glandula sublingualis, to the frænum of the tongue, where it terminates by a small orifice in form of a papilla.

581. The glandulæ sublinguales are likewise two in number, of the same kind with the former, only smaller, something oblong, and flattened like a blanchéd almond. They are situated under the anterior portion of the tongue one on each side, near the lower jaw, on the lateral portions of the musculi mylo-hyoidæi which sustain them. The two extremities of each gland are turned backward and forward, and the edges obliquely inward and outward.

582. They are covered on the upper side by a very thin membrane, which is a continuation of the membrane that covers the under side of the tongue. They send out laterally several small short ducts which open near the gums by the same number of orifices, all ranked in the same line, at a small distance from the frænum, and a little more backward. In many animals we find particular ducts belonging to these glands, like those of the glandulæ maxillares, but they are not to be found so distinctly in men. The musculi genio-glossi lie between the two sublingual glands, and also between the two maxillary ducts.

583. The molares are two glands nearly of the same kind with the former, each of them being situated between the

masseter and buccinator; and in some subjects they may easily be mistaken for two small lumps of fat. They send out small ducts which perforate the buccinator, and open into the cavity of the mouth, almost overagainst the last dentes molares; and from thence M. Heister, who first described them, called them *glandulæ molares*.

584. All the inside of the cheeks near the mouth, is full of small glandulous bodies, called *glandulæ buccales*, which open by small holes or orifices through the inner membrane of the mouth. The membrane which covers the inside of the lips, a continuation of that on the cheeks, is likewise perforated by a great number of small holes, which answer to the same number of small glands, called *glandulæ labiales*. The *glandulæ linguales* are those of the foramen cæcum of the basis of the tongue, which have been already spoken to.

585. I have also explained the *glandulæ palatinæ*, or those that belong to the arch and septum of the palate; and the *glandulæ arytenoidææ* were described with the larynx. The uvular glands are only a continuation of the membrane of the palate in form of a small bunch of grapes. We might likewise reckon among the salival glands those of the superior portion of the pharynx, mentioned in the description of that part, and also the glandular bodies of the *membrana pituitaria* of the nares, and of the sinuses that communicate with these.

586. The *amygdalæ* are two glandular bodies of a reddish colour, lying in the interstices between the two lateral half-arches of the septum palati, one on the right, the other on the left side of the basis of the tongue. Their appearance is not unlike that of the outside of an almond shell, both because their surface is uneven, and because it is full of holes big enough to admit the head of a large pin.

587. These holes which represent a sieve, or a piece of net-work, are continued to an irregular sinus or cavity within the gland, filled commonly with a viscid fluid, which comes from the bottom of the sinus, and is from thence gradually discharged through these holes into the throat. To see the true structure of the *amygdalæ*, they must be examined in clear water, having first been washed in lukewarm water, and handled very gently,

588. The

588. The thyroide gland is a large whitish mass which covers the anterior convex side of the larynx. It seems at first sight to be made up of two oblong glandular portions, united by their inferior extremities, below the cricoide cartilage, in such a manner as to have some resemblance to a crescent, with the cornua turned upward. It is of a moderate thickness, and bent laterally like the thyroide cartilage, from which its name is taken. The two lateral portions lie on the musculi thyro hyoidæi, and the middle or inferior portion, on the crico-thyroidæi. The thyro-pharyngæi inferiores send fibres over this gland, and they communicate on each side by some such fibres, with the sterno-thyroidæi and hyo-thyroidæi.

589. This gland seems to be of the same kind with the other salival glands, but it is more solid. Some anatomists thought they had discovered the excretory duct, but they mistook a blood-vessel for it. We sometimes meet with a kind of glandular rope which runs before the cartilago thyroides, and disappears before the basis of the Os Hyoides.

590. This glandular rope goes out from the common basis of the lateral portions of the thyroide gland, and is lost between the musculi sterno-hyoidæi, behind the basis of the Os Hyoides, or between that basis and the epiglottis. I have likewise shewn, in my private courses, small openings on the side of the anterior ligament of the epiglottis, or that by which it is connected to the basis of the tongue. One of these openings appears like a small papilla; and this is the furthest that I have been able to trace the glandular rope.

### § 7. *Glandule lymphaticæ.*

591. Below each of the first salival glands above described, or parotides, toward the mastoide apophysis, is fixed a small gland of another kind, differing from the former in figure, colour, excretory duct, and in the fluid which it secretes. It is round, and of an even surface, without tubercles, and it is the uppermost of a great number of glands of the same kind, which lie partly below the interstice between the parotid and maxillary glands, and at different distances, along the internal jugular vein, all the way to the lower part of the neck. We observe among these glands and upon this vein



a great number of transparent vessels, with an appearance of numerous valves. The fluid which they contain is transparent, a little mucilaginous, and is called *lymph*.

592. The vessels are likewise termed *lymphatic vessels*, and the glands, *lymphatic glands*. These glands are not all equally large, nor equally round, some being oblong, thick, flat, small, &c. The lymphatic vessels go out alternately by one extremity from one gland, and enter by the other extremity some other gland near the former, and both as they go out and as they enter, these extremities are very much ramified. The trunk is commonly single, and the valves are so disposed, as that the fluid contained in the vessel can only run toward the thorax, but cannot return to the head.

593. These glands and vessels are to be found in many other parts of the body. We meet with them not only in several parts of the head, but also in many outward and inward parts of the thorax, abdomen, and both extremities. They accompany the maxillary salival glands, as well as the parotides; and there are several spread on the lateral and back-sides of the neck, in the membrana adiposa, near the muscles.

594. In the cavity of the thorax the lymphatic glands are situated at different distances on one side and behind the œsophagus, especially at the place which is even with the fifth vertebra of the back. I have found some on the anterior portion of the diaphragm on one side of the mediastinum; and there are others round the basis of the heart, in the fat which lies there. They are to be met with likewise in the substance of the membrana adiposa which covers the thorax, near the inner surface, especially about the clavicles, and in the cellular interstices of the muscles which lie on the thorax.

595. In the cavity of the abdomen these glands are very numerous, and particularly round the superior orifice, and on the two curvatures of the stomach; on the capsula of the sinus of the vena portæ; on the cellular ligament of the vesicula fellea; near the beginning of the ductus cysticus; at the adhesions of the omentum to the spleen, and to the colon; through the whole extent of the mesentery; at the adhesions of the mesocolon; behind the adhesions of these two membranes to the vertebræ of the loins; near the bifurcation of the aorta; and along the iliac vessels. There are likewise

likewise other such glands on the outside of the abdomen, in the substance, and toward the inside of the membrana adiposa.

596. In the superior extremities of the body, these glands lie chiefly under the articulation of the Os Humeri with the scapula in the hollow of the axilla. The most considerable lymphatic glands in the lower extremity, are toward the lower part of the inguina, commonly called the *inguinal glands*, to which the fascia lata or crural aponeurosis gives a kind of double capsula which makes some of them lie very near the skin, and the rest at a greater distance from it.

597. As all these lymphatic glands differ more in situation, than in size or figure, they are commonly enumerated and denominated from the places already mentioned, where they lie in the following order. Glandulæ parotides lymphaticæ. Glandulæ maxillares lymphaticæ. Glandulæ jugulares. Glandulæ cervicales. Glandulæ occipitales. Glandulæ claviculares. Glandulæ axillares. Glandulæ thoracicæ. Glandulæ œsophagææ. Glandulæ mediastinæ. Glandulæ cardiacæ. Glandulæ ventrales externæ, internæ. Glandulæ stomachicæ. Glandulæ hepaticæ. Glandulæ cysticæ. Glandulæ epiploicæ. Glandulæ mesentericæ. Glandulæ lumbares. Glandulæ iliacæ. Glandulæ inguinales. Glandulæ crurales, &c.

598. There are three sorts of vessels that now go by the name of *lymphatics*, whereas formerly that word was used only to signify the transparent vessels already mentioned, which accompany the lymphatic glands. The original sources of these vessels are very difficult to be found out; and even their distribution through the body has not been sufficiently traced to enable us to describe them particularly in this treatise, and therefore I must reserve that for the subject of another. As to their termination, we are sure that for the most part they end in the ductus thoracicus,

599. Besides these vessels which accompany the glands, there are others of the same structure found on the several viscera, where no lymphatic glands have hitherto been discovered. We meet with them in very great numbers in the external membrane of the liver, and in the duplicature of the superior membranous ligament of this viscus, as I have already observed. Several discoveries have been made about these

these vessels in brutes, which I here pass over in silence, the sole design of this work being to describe the human body.

600. The third sort of vessels termed *lymphatics*, are the small arteries and veins which in the natural state transmit only the serous part of the blood. These vessels differ from those of the first in the smallness of their diameter, and in their structure and situation. All these little arteries and veins are uniform, extremely narrow; and their sides are not thinner than those of the valvular lymphatics, yet their diameters are generally less. The other lymphatics are full of valves, and very thin, but they are not narrow in proportion. The arterial and venal lymphatics are found on the parts which are naturally white, as on the skin, the white of the eye, &c. and their origins are easily discoverable; but the valvular lymphatics are confined to the internal parts of the body, and are found on parts of all colours that are in the body, and we cannot easily trace them to their original sources.

601. Besides what has been here said about the glands, I have explained several things relating to them in the compendious view, in the description of the liver, and in the description of the cortical substance of the brain. I have only here to add, that in order to have a general enumeration of all the glands of the human body, we need only add to the salival and lymphatic glands, all the particular glands and glandular viscera which have been explained in the descriptions of the abdomen, thorax, and head.

602. I think it very proper that the ancient division of glands into conglobate and conglomerate should be retained. Under the first kind I include the lymphatic glands alone, and all the other glands of the body under the second; and these again may be subdivided into simple and compound. I must be obliged to refer what still remains to be said concerning the internal structure of glands and glandular bodies to a particular dissertation, which is designed to contain an answer to M. Helvetius's letter, published at the end of his late performance concerning the pulmonary blood.



## Fig. III.

- a. The musculus depressor narium entirely.
- b. Musculus obicularis labiorum.
- c. Buccinator
- d. Musculicani.

## Fig. IV.

The musculus temporalis, extra situm.

## Fig. V.

- a. Musculi sterno hyoidæi.
  - b. Musculus coraco-hyoidæus, or omo-hyoidæus.
  - c. The middle tendon of this muscle.
  - d. Musculus mylo-hyoidæus, called here *genio-hyoidæus externus, sive obliquus*.
  - e. Musculus genio hyoidæus, called here *genio-hyoidæus internus, sive rectus*.
  - f. The stylo-hyoidæus of the right side.
  - g. Cerato-glossi, or hyo-cerato-glossi.
  - h. Stylo-glossi.
  - i. Os hyoides.
  - k. Glandullæ sublinguales.
  - l. Glandula thyroidæa.
  - m. The appendix of that gland.
- Addition.*
- n. Musculus sterno thyroidæus.

## Fig. VI. and VII.

These two figures are nearly the same with the second.

## Fig. VIII.

- a. Aspera arteria.
- b. Oesophagus.
- c. Musculus colli longus.
- d. The glandula thyroidæa, which appears to be divided.
- e. The appendix to that gland, according to Morgagni.
- f. Musculi crico-thyroidæi.
- g. Cartilago thyroides.
- h. Musculus thyro-pharyngæus.
- i. Musculus stylo-pharyngæus sinister.

k. The tendon and common insertion of that muscle.

l. Musculi basio-glossi. That on the right side appears like a genio-glossus.

m. Os hyoides.

n. Musculus genio-hyoidæus obliquus, which is more properly named *genio-glossus*.

o. Genio hyoidæus rectus. It appears here like a portion of the basio-glossus.

q. Stylo-glossus.

## Fig. IX. and X.

The officula auditus. The stapes and muscle of the malleus were discovered by Eustachius.

## Fig. XI.

- a. Musculi basio-glossi. That on the right side appears here like a genio-hyoidæus.
- b. Cerato-glossi sinister.
- c. Stylo-glossus sinister.
- d. Stylo-pharyngæus sinister.
- e. Oesophagus. This appears rather to be the thyro-crico-pharyngæus, raised and inverted.
- f. Stylo-hyoidæus sinister.
- g. Circo-thyroidæus sinister.
- h. Aspera arteria.
- i. A portion of the Oesophagus, cut off.

*Addition.*

- k. The ligament of the stylo-glossus.
- l. Musculus cerato-pharyngæus.
- m. Syndesmo-pharyngæus. These two muscles cover the middle portion of the stylo-pharyngæus.
- n. The lower portion of the stylo-pharyngæus, inserted partly in the cartilago-thyroides, and partly in the cornu of the os hyoides.
- o. The basis of the os hyoides.
- p. The left cornu of that bone.
- q. Cartilago thyroides.

## Fig. XII.

a. The basis of the os hyoides.

h. The

- b. The notch and left side of the cartilago thyroides.
- c. Musculus hyo thyroidæus sinister.
- d. Sterno-thyroidæus sinister.

*Addition.*

- e. A small distinct muscle.
- f. Another.
- g. The basis of the os hyoides.
- h. The left great cornu.
- i. The left small cornu or appendix.

Fig. XIII.

- a. Musculus pterygoidæus internus.
- b. Pterygoidæus externus.
- c. The musculus colli longus superior of the left side, which is likewise called *reclus anterior*.

- d. Longus colli inferior of the right side.

*Addition.*

- e. Musculus salpingo-laphylinus, or rather the ptery-salpingoides.
- f. The obliquus anterior of the right side.
- g. g. Recti minores five laterales anteriores.
- h. h. The lower jaw divided by the chin.

Fig. XIV.

This figure does not appear in human subjects.

### Table DD, the 42d of Eustachius.

*Lancisi's explication.*

Fig. I.

- a. The epiglottis raised a little.
- b. b. The two tops or small heads of the cartilagine arytеноides.
- c. The left ala of the cartilago thyroides, extra situm.
- d. The superior apophysis or cornu of that ala.
- e. The inferior apophysis or cornu.
- f. The right ala, in situ.
- g. Musculus thyro-arytenoidæus sinister.
- h. Crico arytеноidæus lateralis.
- i. Crico-arytenoidæus posterior.
- k. k. Arytenoidæus.
- l. Aspera arteria.
- m. A portion of the musculus œsophagæus. This appears rather to be the membranous portion of the aspera arteria.

*Addition.*

- n. The left, small, lateral, articular side of the cartilago cricoides, with which the inferior apophysis of the cartilago thyroides is articulated.

Fig. II.

- a. The inner side of the epiglottis.

- b. b. Musculi arytеноidæi.
- c. c. Crico-arytenoidæi posteriores.
- d. d. The posterior and lower side of the cartilago cricoides.

*Addition.*

- e. The prominent line on the back-side of the cricoides.
- f. Musculus arytеноidæus verus.
- g. g. The heads of the cartilagine arytеноides.
- h. h. The superior cornua of the cartilago thyroides.
- i. i. The inferior cornua.

Fig. III.

- a. Rimula laryngis.
- b. Musculus hyo-thyroidæus sinister.
- c. Sterno-thyroidæus sinister.
- d. Pharynx.
- e. Oesophagus.

*Addition.*

If this figure be taken from an human subject, it is a very extraordinary one.

Fig. IV. and VI.

- a. The point of the tongue.
- b. The basis of the tongue.
- c. c. and d. d. The musculi styloglossi cut; according to Lancisi.
- e. e. and f. f. Stylo-pharyngæi.

g. g.

g. g. Cephalo-pharyngæi, united by a linea alba.

h. h. Oesophagus; or rather the cerato-syndesmo-pharyngæus.

i. The opening of the pharynx.

k. k. Oesophagus.

l. l. Aspera arteria.

*Addition.*

m. Musculus hyo-cricico-pharyngæus.

n. n. Glosso-pharyngæi,

o. A portion of the stylo-pharyngæus.

p. p. p. p. The velum or septum palati.

q. q. The arch of the pharynx, with the rugæ.

r. r. Musculi petro-pharyngæi.

s. Stylo-pharyngæus minor D. Santorini.

t. t. t. t. Peristaphylini externi.

*Fig. V.*

a. The tongue.

b. Epiglottis.

c. Ligamentum epiglotticum morgagnii, five glosso epiglotticum.

d. Ligamentum hyo-epiglotticum finitum.

e. Os hyoides.

f. The glands of the basis of the tongue.

*Fig. VII.*

A fore-view of the cartilago cricoides.

a. The forepart.

b. The backpart.

c. c. The small articular heads or tops.

*Fig. VIII.*

A side-view of the cricoide cartilage in which the small articular surface expressed in fig. 1. is left out.

a. The anterior part or basis.

b. The posterior or upper part.

c. The lateral part, in which the small articular surface is wanting. Vide fig. 1. n.

*Fig. IX.*

a. The right side of the cartilago thyroides.

b. The right side of the cartilago cricoides.

c. Epiglottis.

d. The right superior cornu of the cartilago thyroides.

e. The left superior cornu.

f. The right inferior cornu.

*Fig. X.*

A back view of the cartilago cricoides.

a. The prominent line.

b. b. The lateral sides.

c. c. The small articular eminences or heads.

*Fig. XI.*

a. Epiglottis.

b. The right superior cornu of the cartilago thyroides.

c. The superior portion or head of the right arytenoide cartilage.

d. d. The orifice of the right ventricle of the larynx.

e. The right portion of the cricoides.

g. An anterior section of the cricoides.

h. A posterior section.

*Fig. XII.*

One of the arytenoide cartilages cleared from the muscles.

*Addition.*

a. b. The basis of this cartilage.

b. The internal angle of the basis.

c. The articular cavity of the basis.

d. The appendix or small head of this cartilage.





# NEW BOOKS

Sold by

THOMAS STREET,  
BOOKSELLER,

At No. 39, in the

B O R O U G H,

Three Doors from St. THOMAS'S HOSPITAL,

Where GENTLEMEN may be served with  
BOOKS (neatly Bound in Calf and Letter'd)  
as CHEAP as at any SHOP in LONDON,  
*viz.*

|                                              |                    | <i>l.</i> | <i>s.</i> | <i>d.</i> |
|----------------------------------------------|--------------------|-----------|-----------|-----------|
| Pott's Works compleat, 4 Vols. 8vo           | _____              | 1         | 2         | 0         |
| Winslow's Anatomy, 4to.                      | _____ Lond. Edit.  | 0         | 16        | 0         |
| Ditto 2 Vols. 8vo.                           | _____ Edinb. Edit. | 0         | 10        | 0         |
| Macquer's Chymistry, 2 Vols. 8vo.            | _____ Lond. Edit.  | 0         | 10        | 0         |
| Ditto 3 Vols. 12mo.                          | _____ Edinb. Edit. | 0         | 7         | 6         |
| Douglas on the Muscles, 12mo.                | _____              | 0         | 3         | 0         |
| Pope's Works, 6 Vols. 12mo. Cutts.           | _____ Lond. Edit.  | 0         | 18        | 0         |
| Ditto 6 Vols. 12mo.                          | _____ Edinb. Edit. | 0         | 14        | 0         |
| Cheselden's Anatomy, 8vo.                    | _____              | 0         | 6         | 0         |
| Milton's Paradise Lost, Cutts, 12mo.         | _____ Lond. Edit.  | 0         | 3         | 6         |
| Ditto                                        | _____ Edinb. Edit. | 0         | 2         | 6         |
| Ditto Paradise Regain'd, &c. Cutts, 12mo.    | _____              | 0         | 3         | 0         |
| Modern Practice of London Hospitals, 12mo.   | _____              | 0         | 3         | 0         |
| New Dispensatory, 8vo.                       | _____              | 0         | 7         | 0         |
| Hervey's Meditations, 12mo.                  | _____              | 0         | 3         | 0         |
| Smellie's Midwifery, 3 Vols. 8vo.            | _____              | 0         | 18        | 0         |
| Monro's Anatomy, 12mo.                       | _____              | 0         | 3         | 6         |
| Spectator, with Frontispieces, 8 Vols. 12mo. | _____              | 0         | 16        | 0         |
| Dr. Young's Night Thoughts, 12mo.            | _____ Lond. Edit.  | 0         | 3         | 0         |
| Ditto                                        | _____ Edinb. Edit. | 0         | 2         | 6         |
| Goulard on Lead, sewed, 12mo.                | _____              | 0         | 3         | 0         |
| Keil's Anatomy, 12mo.                        | _____ Lond. Edit.  | 0         | 3         | 0         |
| Ditto                                        | _____ Edinb. Edit. | 0         | 2         | 6         |
| Brooke's Practice of Physic, 2 Vols. 8vo.    | _____              | 0         | 10        | 0         |

|                                                       |              |  | <i>l.</i> | <i>s.</i> | <i>d.</i> |
|-------------------------------------------------------|--------------|--|-----------|-----------|-----------|
| Armstrong on Infants, 12mo. —                         | Lond. Edit.  |  | 0         | 2         | 6         |
| Ditto — — — — —                                       | Edinb. Edit. |  | 0         | 1         | 6         |
| Smith's Formulæ, sewed, 12mo. — —                     |              |  | 0         | 5         | 0         |
| Hayes's Interest, 18mo. — — — —                       |              |  | 0         | 2         | 0         |
| Warner's Description of the Human Eye, 8vo. sewed     |              |  | 0         | 2         | 6         |
| Ditto on the Testicles, 8vo. sewed — —                |              |  | 0         | 2         | 0         |
| London Practice of Physic, 12mo. — —                  |              |  | 0         | 5         | 0         |
| The Adventures of Gil Blas, 4 Vols. 18mo. Lond. Edit. |              |  | 0         | 8         | 0         |
| Ditto — — — — —                                       | Edinb. Edit. |  | 0         | 6         | 0         |
| Gay's Fables, 12mo. Cutts, — — — —                    | Lond. Edit.  |  | 0         | 3         | 0         |
| Ditto without Cutts. — — — — —                        | Edinb. Edit. |  | 0         | 1         | 6         |
| Else on the Hydrocele, 8vo. sewed — —                 |              |  | 0         | 1         | 6         |
| Sharp's Surgery, 8vo. — — — — —                       |              |  | 0         | 4         | 6         |
| Ditto Critical Enquiry, 8vo. — — — —                  |              |  | 0         | 4         | 6         |
| Thompson's Seasons, 12mo. — — — —                     | Lond. Edit.  |  | 0         | 3         | 0         |
| Ditto — — — — —                                       | Edinb. Edit. |  | 0         | 2         | 6         |
| Gooche's Cases in Surgery, 3 Vols. 8vo. —             |              |  | 0         | 19        | 6         |
| Heister's Surgery, 4to. — — — — —                     |              |  | 1         | 1         | 0         |
| Hewson on the Properties of the Blood, 8vo. sewed     |              |  | 0         | 3         | 6         |
| Fisher's Arithmetic, 12mo. — — — —                    |              |  | 0         | 2         | 6         |
| Ditto Companion, 12mo. sheep — — — —                  |              |  | 0         | 2         | 0         |
| Death of Abel, 12mo. — — — — —                        |              |  | 0         | 3         | 0         |
| Doddsley's Select Fables, 12mo. — — — —               |              |  | 0         | 3         | 0         |
| Messiah, 3 Vols. 12mo. — — — — —                      |              |  | 0         | 9         | 0         |
| Tiffot's Disorders on People of Fashion, 12mo. }      |              |  | 0         | 3         | 0         |
| — — — — — Lond. Edit. }                               |              |  |           |           |           |
| Ditto — — — — —                                       | Edinb. Edit. |  | 0         | 2         | 6         |
| Mrs. Glafs's Cookery, 8vo. — — — —                    | Lond. Edit.  |  | 0         | 5         | 0         |
| Ditto — — — — —                                       | Edinb. Edit. |  | 0         | 3         | 0         |
| White's Cases in Surgery, 8vo. — — — —                |              |  | 0         | 4         | 6         |
| Rowley on Ulcerated Legs — — — — —                    |              |  | 0         | 1         | 6         |
| Mackbride's Introduction to Theory and Practice }     |              |  | 1         | 1         | 0         |
| of Physic, 4to. Boards — — — — — }                    |              |  |           |           |           |
| New Manual of Devotions, 12mo. — — — —                |              |  | 0         | 3         | 0         |
| Quincey's Dispensatory, 8vo. — — — —                  |              |  | 0         | 6         | 0         |
| Haller's Physiology, 2 Vols. 8vo. — — — —             |              |  | 0         | 12        | 0         |
| Plate Glass Book — — — — —                            |              |  | 0         | 3         | 6         |
| Hoppus's Measuring, 8vo. — — — — —                    |              |  | 0         | 2         | 6         |
| Miller's Kalender, 8vo. — — — — —                     |              |  | 0         | 5         | 0         |
| Mawe's Gardening, 8vo. — — — — —                      |              |  | 0         | 5         | 0         |
| Jenk's Cookery, 12mo. — — — — —                       |              |  | 0         | 3         | 6         |
| Watts' Hymns and Psalms bound together, 12mo.         |              |  | 0         | 3         | 0         |
| Hoyle's Games, 12mo. — — — — —                        |              |  | 0         | 3         | 0         |
| Croxall's Fables, 12mo. — — — — —                     |              |  | 0         | 3         | 0         |
| Bailey's Etymological English Dictionary, 8vo.        |              |  | 0         | 6         | 0         |
| Drelincourt on Death, 8vo. — — — — —                  |              |  | 0         | 4         | 6         |
| Mortimer's every Man his own Broker — — — —           |              |  | 0         | 3         | 0         |
| Religious Courtship, 12mo. — — — — —                  |              |  | 0         | 3         | 0         |



|                                                                                                 | <i>l.</i> | <i>s.</i> | <i>d.</i> |
|-------------------------------------------------------------------------------------------------|-----------|-----------|-----------|
| Pantheon by Tooke, 8vo. — —                                                                     | 0         | 3         | 6         |
| Compleat Grazier, 12mo. — —                                                                     | 0         | 3         | 0         |
| History of England in Question and Answer, 12mo. — —                                            | 0         | 2         | 0         |
| Pleasing Instructor, 12mo. — —                                                                  | 0         | 3         | 0         |
| Fugitive Pieces, (Doddsley's) 2 Vols. 8vo. — —                                                  | 0         | 6         | 0         |
| Pope's Essay on Man, 12mo. — —                                                                  | 0         | 2         | 0         |
| Patterson's New and Accurate Description of }<br>the Roads, sewed — — }                         | 0         | 1         | 6         |
| Ditto Travelling Dictionary, being a Second }<br>Part to the above, sewed, 12mo. — }            | 0         | 4         | 0         |
| Entick's New Spelling Dictionary — —                                                            | 0         | 2         | 0         |
| Langley's Builders Jewel — —                                                                    | 0         | 4         | 6         |
| Owen's Book of all the Fairs in England and }<br>Wales, sewed — — }                             | 0         | 1         | 0         |
| Elemer's Tables of Weights and Prices on a New }<br>Plan, for Dealers in Hops, Wool, Hay, &c. } | 0         | 2         | 6         |
| Traders Sure Guide — —                                                                          | 0         | 1         | 6         |
| New Duty of Man, 12mo. — —                                                                      | 0         | 3         | 6         |
| Ditto, 8vo. — —                                                                                 | 0         | 5         | 0         |
| Compleat Letter Writer — —                                                                      | 0         | 2         | 6         |
| Chamber's Cookery or Lady's best Companion, sewed                                               | 0         | 2         | 0         |
| Cook's Compleat Letter Writer, 12mo. — —                                                        | 0         | 2         | 0         |
| A New Collection of Entertaining Voyages and }<br>Travels, by Edward Cavendish Drake, Esq; }    | 1         | 16        | 0         |
| Illustrated with Maps and Copper-Plates, Folio }                                                |           |           |           |
| Essay on Oratory — —                                                                            | 0         | 0         | 6         |
| Economist — —                                                                                   | 0         | 1         | 0         |
| Spouter's Companion or Theatrical Remem- }<br>brancer — — }                                     | 0         | 1         | 0         |
| Ten Minutes Advice to a Gentleman going to }<br>Purchase a Horse — — }                          | 0         | 1         | 0         |
| Ladies Polite Songster — —                                                                      | 0         | 1         | 6         |
| Gentlemen's Pocket Farrier — —                                                                  | 0         | 1         | 0         |
| Easy Way to prolong Life. Part I. — —                                                           | 0         | 2         | 0         |
| Ditto — — Part II. — —                                                                          | 0         | 1         | 6         |
| Compleat English Gardener. By Samuel Cooke                                                      | 0         | 1         | 6         |
| Remarks on the English Language — —                                                             | 0         | 2         | 0         |
| Compleat English Cook, with Cutts, by Brooks                                                    | 0         | 1         | 0         |
| Theatres, a Poetical Dissection, 4to. — —                                                       | 0         | 2         | 6         |
| Compleat Bigd Fancier, by Wright — —                                                            | 0         | 1         | 0         |
| Richard Plantagenet, a Legendary Tale, by }<br>Mr. Hull — — }                                   | 0         | 2         | 0         |
| Cheats of London Exposed, with Cutts — —                                                        | 0         | 1         | 0         |
| The Robin, or Ladies Polite Songster, 12mo. — —                                                 | 0         | 2         | 6         |
| Royal Cook, by Mrs. Pennington — —                                                              | 0         | 1         | 6         |
| Book of Coach Rates — —                                                                         | 0         | 1         | 0         |
| Pomfret's Poems, 12mo. — —                                                                      | 0         | 2         | 0         |
| Joe Miller's Jests — —                                                                          | 0         | 1         | 6         |

|                                                                | <i>l.</i> | <i>s.</i> | <i>d.</i> |
|----------------------------------------------------------------|-----------|-----------|-----------|
| Dilworth's Book-keeping                                        | 0         | 2         | 0         |
| —— Description of the Globes, stich'd                          | 0         | 2         | 6         |
| Ben Johnson's Jest                                             | 0         | 1         | 0         |
| Shakespear's Jest                                              | 0         | 1         | 6         |
| Food for the Funny, or a Medley of Mirth                       | 0         | 0         | 6         |
| The Book of Oddities, by Jack Strange                          | 0         | 1         | 6         |
| British Letter Writer                                          | 0         | 1         | 6         |
| Unfortunate Englishman, or Adventures of John<br>Cockburn      | 0         | 1         | 6         |
| History of Mademoiselle de Belean, or the New<br>Roxana, sewed | 0         | 2         | 6         |
| Æsop's Fables, New Edition, Cutts                              | 0         | 2         | 0         |
| Economy of Human Life, 12mo. Lond. Edit.                       | 0         | 2         | 6         |
| Ditto Edinb. Edit.                                             | 0         | 1         | 0         |
| A Treatise of a Cataract, &c. Cutts, by George<br>Chandler     | 0         | 2         | 6         |

N. B. Bibles, Common Prayers, Testaments, Spelling Books, Novels, Plays, and all other New Publications on the lowest Terms.

\* \* \* Also proper Allowance will be made to Merchants, Country Dealers, Captains of Ships, &c. who take Quantities of the above Books.